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CONTENTS

EDITORIAL:
- Science and Practice at Odds . . . 439
- The Underwriters' Electric Meeting . . . 440
- The Generation of Electric Currents from Light . . . 440
- The Arc as a Source of Light . . . 441

American Institute of Electrical Engineers . . . 442
The Mechanical Equipment of the Hotel Knickerbocker . . . 445
A New Mercury Vapor Lamp . . . 449
How to Remedy the Effects of Foreign Current on Automatic Block Signals . . . 450
The Societa Hidroelectrica del Guadiero 50,000-Volt Development . . . 451
International Book and Paper Exposition . . . 451
The Proposal of the New York and the New York & New Jersey Telephone Companies for a Monopoly of Service in the Greater City . . . 452
Methods of Creosote Analysis . . . 452
Annual Dinner of the Harvard Engineering Society . . . 452
The Power Plant of the Quintard Iron Works Company, of New York City . . . 453
Preliminary Outline of the Dedication of the Engineering Societies' Building . . . 458
The New York Central Accident . . . 459
Big Telephone Project . . . 459
The Quarter-Century Number . . . 459
The Iowa Independent Telephone Association . . . 459
The National Electric Light Association Convention . . . 459
REVIEWS OF CURRENT ENGINEERING AND SCIENTIFIC LITERATURE . . . 460
A Correction . . . 461
METHODS OF GETTING NEW BUSINESS . . . 462
New York Electrical Society . . . 465
The Technical Publicity Association . . . 465
INDUSTRIAL SECTION:
- General Electric Fan Motors for 1907 . . . 466
- Diehl Fans for 1907 . . . 467
- The "Stayright" Fixture . . . 468
- A Notable Order for Measuring Instruments . . . 468
- General Electric to Build at Erie, Pa . . . 468
- "A Tale of Two Types" . . . 469
- The New Trumbull Catalogue . . . 469
- Flaming Arc Lamps . . . 469
- A New Ground Clamp . . . 469

CURRENT ELECTRICAL NEWS . . . 470
RECORD OF ELECTRICAL PATENTS . . . 475

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SCIENCE AND PRACTICE AT ODDS.

In its endeavor to meet the demands for electric power of the great city of London, the London County Council erected a large generating station on the river Thames. When authority was being asked of Parliament to build this station, no objection was made, although it stands on the meridian of Greenwich and only about a mile to the north; but as soon as the station was put into service, a few months since, the authorities of Greenwich Observatory discovered this fine building on their northern horizon, and they could make out magnificent smoke-stacks, from which occasionally smoke issued. They found upon closer investigation that the station was equipped with reciprocating engines of large size, and it was believed that, when running, these engines gave rise to vibrations which, to some extent, interfered with the observatory's operations. Complaint was therefore made, although it would seem to many that these troubles should have been anticipated and opposition to the new power station exerted before the city had gone so far with its work.

The matter, however, was in some ways serious, and in an endeavor to rectify it, committees were appointed by the observatory and by the London County Council to go into the problem thoroughly. This committee made an exhaustive inquiry, and has recently made public its conclusions and recommendations, which are of no little interest.

In the first place, it has been decided to leave matters alone, so far as the old equipment is concerned, for a year or so, so that more can be learned about the vibrations set up at the observatory. Next, it was decided that turbines should be adopted instead of reciprocating engines for the new equipment of the second section of the power-house, which is to be erected shortly, and much attention should be given to securing perfect balance of the rotating parts. Furthermore, it is agreed that after the turbine equipment is in place the reciprocating engines shall not be used at night after 10 o'clock except under unusual conditions, and their running is to be restricted as much as possible during the earlier part of the evening. With respect to the trouble caused by the chimneys, the agreement is that no new chimneys shall be higher than 204 feet, and the gases issuing from these must not be hotter than 250 degrees Fahrenheit, conditions which are met by the present station. It seems that the heat from the gases interferes more with astronomical work than the smoke which occasionally can not be avoided.

The result of the investigation amounts merely to leaving the conditions as they are and attempting to avoid the disturbances by adopting a different type of equipment for the new

section. It seems rather a pity that these difficulties were not thought of before. Astronomical work is difficult enough under the best conditions, and all chances of possible disturbance should be thought of in advance and steps taken to prevent them, if this does not interfere too greatly with public needs.

THE UNDERWRITERS' ELECTRIC MEETING.

The notice of the meeting of the Committee of the Underwriters' National Electric Association to be held in New York, March 27 and 28, is attracting unusual attention by reason of the present magnitude of the growing interests involved in any action which such a body may undertake.

Although this is the fifteenth meeting, the calendar has been changed from that of previous meetings, early in December, to this present date, late in March.

The personnel of the twelve members of the electrical committee appointed at the first and only meeting of the whole association, held at Chicago during the Exposition of 1893, remains the same except that of the two new members, who take the place of those who have entered into more advantageous connections during the year.

The meeting is to be devoted to a consideration of various amendments to the National Electrical Code which have been submitted as the reports of committees, or in the form of numerous suggestions, of which it is stated that one-tenth have been submitted from some responsible source, such as an organization representing the combined opinion of a number of people, and nine-tenths being the personal contributions of individuals.

These amendments cover nine closely printed quarto pages, and represent incongruities of personal notions, as well as evidently well-considered results of experience.

While these columns may not be at this time the place to enter into a detailed consideration of these hundreds of suggested changes, yet it is with a sense of relief that the notice of the secretary, Mr. C. M. Goddard, states:

"It has always been the endeavor of our Electrical Committee to make only such changes in the Code as are made necessary by progress in the art, or such as have been shown by some field experience to be necessary to safeguard against hazard, and we believe this course meets with the approval of the electric lighting and contracting interests, as changes in the Code, even if necessary, cause more or less confusion and trouble."

That the National Electrical Code has a place in American electrical practice is evident by the care which electrical interests devote to its provisions.

Its whole force rests upon its equities, and these equities are dependent alike upon the enforcement as well as the letter of the regulations.

That these questions will receive competent scrutiny goes without question, as the Code Committee of the National Electric Light Association will hold a meeting for the purpose, the day before that of the Underwriters, for which the preparation by means of interrogatories to all interests involved has been most thorough.

On the day after the meeting of the Underwriters the National Conference on Standard Electrical Rules will hold its meeting, at which the commercial, operating, manufacturing and insurance interests will confer together upon the results of the general meeting the day before.

Although it appears that the relations of the underwriters to electricity differ from their course with other industries, yet to the extent that these rules are a composite of the experiences of those engaged in applications of electricity to the service of mankind, their purpose is to be commended.

It is evident that in the representatives of these various electrical industries, there will be assembled at these various meetings those who will form a concensus of opinion on the subjects under consideration, and it is sincerely hoped that the rules will be amended only from the standpoint of correction and toward simplicity.

It is of the greatest importance to all interested in the applications of electricity—and that is everybody—that changes should be made only for well-established cause and not from an academical standpoint.

If any provision of the Code has failed to obviate preventable hazards, then those connected with that branch of the industry should be called upon to devise an efficient remedy, and doubtless they will be as ready to perform such service in the future as they have been in the past.

It is assumed that the phraseology of these rules makes no pretence to literary excellence, but if it is reported by those in the field that any clauses have been misunderstood by those engaged in practical electrical work, and such allegations have been made in the past, then such rules should be redrawn in clear phrase to prevent a continuance of such misunderstandings.

The advances in electrical applications and the light of continued experiences over larger ranges may require corresponding modifications in the Code, but those entrusted with the work, and also its attendant responsibility, should remember the words of Dumas, "The highest achievement of invention is in simplicity."

THE GENERATION OF ELECTRIC CURRENTS FROM LIGHT.

Maxwell's electromagnetic theory leads to the conclusion that a pressure is set up in the medium when light is radiated through it. There have been many attempts to observe this pressure, but the difficulties are exceedingly great, and as yet no satisfactory results have been obtained. Experiments in this direction frequently lead to others of considerable interest. An instance of this is given by the efforts of A. Bartoli to set up an electric current by means of a beam of light. Bartoli, having failed to observe the Maxwell pressure, thought that possibly he might be able to generate an electric current through the influence of a ray of light. The latter being, according to theory, an

electromagnetic wave, should set up an electromotive force in conductors upon which it falls. However, the frequency of the light waves is so high that the impedance of a metallic surface will prevent the flow of current under ordinary conditions. Moreover, with ordinary light there would be no resulting effect, and even with polarized light the electromotive forces generated would be alternating and action confined to a thin layer of the surface, the layer immediately beneath it acting to short-circuit all molecular paths, making detection impossible.

Bartoli thought that by moving a conductor through a beam of light at a very great speed, he might be able to unbalance the electromotive forces set up and thus obtain a pulsating effect. He tried an experiment to determine this as long ago as 1880, though he only recently described it. At that time he was working under difficulties, on account of the lack of sensitive instruments and other laboratory facilities. The method consisted in mounting a thin silver ring on an insulated wheel so that it would be revolved in its own plane about its centre. The ring was cut at one point and conductors carried down to suitable slip rings, from which connections were carried to a galvanometer. This ring was revolved in its own plane at the highest speeds obtainable, and a beam of light allowed to fall upon it. It was found that this led to a deflection of the galvanometer, which did not occur when the ring was standing still with the light upon it nor when it was revolved, but without being subjected to the light. The conclusions reached were that this arrangement did demonstrate that a current was set up by a beam of light if the surface upon which it fell was revolved so that the effect of the ray would be unsymmetrical with respect to it.

The amount of action observed by Bartoli was surprisingly large, and led Mr. Bergen Davis to investigate the matter theoretically. He gives his results, which are very interesting, in the *Physical Review* for February. An analytical analysis of the problem leads to the conclusion that the electromotive force which would be set up would be exceedingly small—in fact, very much too small to be detected by the most sensitive galvanometer obtainable to-day. In order to verify these conclusions, a device similar to Bartoli's, though constructed with much greater care, was made. Bartoli's conducting ring was comparatively thick—so thick that the back layers of metal would act as return paths for the surface layer, in which the electromotive forces would be set up. For this reason his ring must have been short-circuited everywhere. Moreover, he did not take any precautions to prevent disturbances due to the air surrounding the revolving ring. Mr. Davis obtained an exceedingly thin ring by silver-plating on glass—so thin that part of the light was transmitted through it. In this way the electromotive forces would be set up throughout the entire thickness of the ring, though, of course, they would be greatest at the surface. The precautions taken to cover up the revolving disc are found to be very necessary; otherwise the galvanometer behaved in an erratic manner, deflecting first in one direction and then in the other. This action disappeared when the ring was properly protected.

The results of the analytical study showed that with an ordinary beam of light an electromotive force of less than 4×10^{-11} will be obtained. This could be increased one hundred times by concentration with a lens. The speed employed was about 6,000 centimetres per second. Various rings were tried, having different resistances, one of these being platinum. Under these conditions no deflection of the galvanometer could be observed—in fact, the sensibility of the galvanometer, although it certainly must have been very much greater than any intrument available in 1880, was still 3,000,000 times too low to observe the small electromotive force which theory indicates should be set up. The conclusion reached is that such an electromotive force must be set up, due to a beam of light, but that it is practically impossible, with any means now at hand, to detect it.

THE ARC AS A SOURCE OF LIGHT.

The incandescent lamp in its new varieties has been receiving much attention of late. Its possibilities for outdoor illumination in the high-candle-power units of high efficiency have suggested to some that it will drive out the arc lamp and considerably restrict the field of the latter; but it should not be overlooked that great advances are being made in the arc lamp itself, even though they are attracting less general interest. A most interesting discussion of this phase of the lighting problem was that given by Dr. Elihu Thomson in the ELECTRICAL REVIEW for March 9. In this Dr. Thomson runs briefly over the history of the arc lamp and points out the peculiar and valuable properties of this type of illuminant. He divides arc lamps into two great classes: those in which light is emitted from incandescent solid bodies—generally the electrodes; and those in which the arc itself is luminous. There are, of course, ways of varying both of these effects, and in some instances the lamp is really a combination of the two, as the arc is luminous not only on account of incandescent vapor, but also the incandescent solid particles entrained in it.

It is worth while pointing out that in some respects the arc lamp affords greater possibilities than the incandescent. The latter must employ a solid radiator, and it is therefore limited by the limits of incandescent solid bodies; and although certain of these bodies may be called selective, using the term to indicate any departure from black-body radiation, the arc lamp has not only this possibility, but it may be selective in another sense: it may—and, indeed, some of the types do—radiate spectral lines or bands. A radiation of this kind will, in general, be more efficient as a light producer than radiation from a solid body. However, it involves what is sometimes a disadvantage; it produces light of a distinctive color. The objection to this must be overcome by employing for electrodes materials which give bands scattered well throughout the spectrum. The most noteworthy instance of this kind is the magnetite lamp, the luminescence of which is produced by incandescent titanium.

American Institute of Electrical Engineers.

The 215th meeting of the American Institute of Electrical Engineers was held in the Engineers' Building, New York city, Friday evening, March 1. The secretary announced that at the meeting of the board of directors held in the afternoon, 125 associates were elected and nine associates were transferred to the grade of member. Also that upon recommendation of the committee on papers and meetings it was decided to hold the annual convention at Niagara Falls during the week beginning Monday, June 24. Niagara Falls had been selected largely on account of its favorable geographical position as regards the centre of membership, and conventions held there in the past had been well attended and eminently successful.

The following papers were read and discussed:

"Alternating-Current Electrolysis," by J. L. R. Hayden.

"Electrolytic Corrosion of Iron and Steel in Concrete," by A. A. Knudson.

"Some Theoretical Notes on the Reduction of Earth Currents from Electric Railway Systems by Means of Negative Feeders," by George I. Rhodes.

The paper by Mr. Hayden describes the methods employed for arriving at the conclusions given regarding alternating-current electrolysis. These tests included the investigation of different current densities and different frequencies. Tests were made with diluted solutions of such salts as may be found in the ground, and also with various kinds of soils. The following conclusions seem to be warranted from the investigations:

Alternating-current electrolysis is not a phenomenon like direct-current electrolysis, on which definite quantitative general laws can be formulated; but is of the character of a secondary effect; that is, the action of the positive half wave is not quite reversed by the action of the negative half wave, leaving a small difference, rarely exceeding one-half per cent of the electrolytic action of an equal direct current.

Alternating-current electrolysis varies from practically nothing to somewhat less than one per cent of direct-current electrolysis. Since electrolytic action of the alternating current appears as a small difference between two large and nearly equal quantities, the action of the positive and of the negative half wave, a very small variation in the action of either half wave makes a very large difference in the result, and this probably accounts for the very large variation in the electrolytic action of alternating current compared with the constancy of the electrolytic action of direct current.

Alternating-current electrolysis, when expressed quantitatively, or in per cent, of the action of an equal direct current, varies very greatly with the chemical character of the electrolyte. The nitrates and similar compounds, as fertilizers, tend to increase electrolytic corrosion; carbonates and, in general, alkaline reaction of the soil, decreases the corrosion; that is, exert a protective action.

In general, lead is more attacked than iron, and the latter shows still more erratic behavior than lead, probably due to the existence of a passive state.

In general, electrolytic corrosion by alternating currents increases with decrease of frequency. This increase with decreasing frequency does not follow a general law, but depends largely upon the chemical character of the electrolyte. It may be enormous; that is, twenty-five-cycle current gives many times greater corrosion than the same current at sixty cycles. Or it may be very small and negligible. In some instances sixty-cycle current seems to give a somewhat greater attack than twenty-five-cycle current.

Chemical corrosion by the soil, and electrolytic corrosion by alternating current increases very greatly with increasing temperature of the soil.

It seems that a direct current superimposed on the alternating current and equal to 1.5 per cent of the alternating current, perfectly protects the lead plates against electrolytic attack by twenty-five-cycle current; so that the corrosion of the lead plates in the soil is reduced to the value of corrosion which would take place spontaneously by the chemical action of the soil, or even less.

The average electrolytic corrosion in ordinary soil, by twenty-five-cycle alternating current, is 0.280 per cent (in soil containing fertilizer it is greater); 1,833 ampere hours would therefore dissolve electrically

$$1833 \times 0.0028 \times 3.86 = 19.85 \text{ grammes of lead.}$$

With a chemical corrosion of 0.0134 milligrammes per square inch an hour, observed, 294 square inches would lose in 478 hours,

$$0.0134 \times 294 \times 470 = 1850 \text{ milligrammes} = 1.85 \text{ grammes.}$$

Without protective action by superimposed direct current, the total corrosion of the lead plates during the twenty days' test therefore should be 21.70 grammes.

By the superposition of 28.2 ampere-hours direct current, or 1.5 per cent of the alternating current, this was reduced to 1.78 grammes.

Or to 8.2 per cent of its former value, showing strong protective action of the superimposed direct current.

The paper by Mr. Knudson dealt with the insulating property of concrete surrounding metallic structures, and the amount of current and time necessary to cause corrosion upon metals encased in concrete or hydraulic cements, and also to test their value as electrolytes. Iron tubes were imbedded in concrete, two blocks being immersed, respectively in fresh water and sea water with current flowing through the blocks, a third block being immersed in sea water, but without current flowing. Two series of tests were made.

These tests and experiments seem to show that only a small fraction of an ampere is necessary to cause electrolytic action. The element of time being always with us, it is only necessary where electric currents are present of sufficient voltage in the proper direction to cause even a very small amount of current to pass that will in time cause corrosion upon interior steel structures, whether placed in concrete, brick or in granite masonry. It is not expected, however, that large granite piers would develop cracks, but electrolysis to interior steel work and to bridge anchorages may go on just the same. Cracks may develop, however, in concrete piers of small bridges, such as those which cross creeks or canals.

The paper by Mr. Rhodes treated the subject of reducing the earth currents from railway systems under several heads: With no copper in the return circuit. With copper of uniform section bonded to the rails at short intervals. Copper distributed to give uniform drop, bonded to the rails at short intervals. A single insulated negative feeder connected to rails at middle of the line and at the power station. A single insulated feeder connecting the rails to the negative bus-bar only at the middle of the line. Several insulated feeders with equal potentials at all feed points. The author arrived at the conclusion that insulating the negative bus-bar very much decreases the leakage current in all cases, the decrease being in the neighborhood of eighty per cent. Further than this, it is unnecessary to consider the case of a solid ground at the power station. With the bus-bar insulated, the leakage currents with the copper either uniformly distributed or distributed for uniform drop, are identical.

With a single feeder to the middle of the line and a connection to the bus-bar at the power station, the results are poorer than for any other method for large feeders, the divergency becoming greater as the amount of copper is increased, but with a single feeder and no other connection between bus-bar or rails, the leakage is independent of the amount of copper used and equal to 4.8 per cent of the original leakage with the bus grounded and no copper in the negative circuit. The superiority of the boosted negative feeder method of reducing leakage from the rails is apparent, two feeders reducing the leakage to 1.2 per cent of its original value with the bus-bar grounded, or about 6.2 per cent of its original value with the bus-bar insulated. Very little is gained by using more than two feeders.

In conclusion the author gives a few figures as to the amount of copper required to reduce the leakage to one-half with the bus grounded. He considers a double-track road with 100-pound rails. The equivalent conductivity of each rail is about 1,200,000 circular mils of copper if well bonded, making 4,800,000.

If the copper is to be of uniform section, 4,800,000 circular mils must be used the entire length of the line.

If the copper is to be distributed to best advantage it must be of a section 9,120,000 circular mils at the power station, being reduced uniformly to zero at a point 65.5 per cent of the distance to

the end of the line. The total amount of copper used will be sixty-two per cent of that in the first case.

If an insulated feeder to the centre of the line is used, with a connection at the power-house it must be of a section 7,200,000 circular mils, making the weight of copper seventy-five per cent of that in the first case.

If the bus-bar is now insulated the 4,800,000 circular mils of copper extending the entire length of the line will reduce the leakage to 9.7 per cent; sixty-two per cent of this copper distributed to best advantage will reduce the leakage to twelve per cent; while a single feeder with a connection at the power-house, using seventy-five per cent of the copper, will reduce it to 10.4 per cent. Using a weight of copper determined only by its carrying capacity and the cost of power, in two boosted feeders, will reduce the leakage to 1.2 per cent with no connection at the power-house, and by using twenty per cent larger feeders, to 0.77 per cent with such a connection.

The discussion on the papers was opened by L. B. Stillwell, of New York city, who said that Mr. Hayden's paper shows that the electrolytic damage to subterranean metallic structures, which alternating currents are liable to cause, is practically negligible under ordinary circumstances. It also indicates that special conditions may exist which call for the adoption of preventive measures. The method of protecting cable sheaths suggested is ingenious. Quantitatively considered, however, his results indicate that it will rarely be necessary to adopt his plan of superimposing a continuous potential upon an alternating potential.

Unfortunately, in the discussion of electrolysis, the lawyer generally has been rather more prominent than the engineer. Too often, also, the engineers, who have been retained by one or the other parties interested have approached the subject from a radically partisan viewpoint. In many of our cities and towns damage, due to electrolysis, is in progress which might be prevented by reasonable application of known principles and methods. That the prevention is not employed is due, in part, to our engineers, but perhaps still more to the general unwillingness of the management of electric railway companies to spend money in preventing damage which is not seen. The duty of the engineer is to exercise his influence to secure a realization of the facts that "an ounce of prevention is worth a pound of cure," and to induce his client to take timely precautions to protect the interests of his neighbors, and, by so doing, to protect his own.

Mr. Rhodes gives an excellent theoretical discussion of the possibilities of an apparatus probably destined to do much more work in the future than it has in the past. Properly applied, it is of the greatest value in minimizing electrolytic damage under certain conditions. The plans of the Hudson companies, in New York city, contemplate the use of boosters to prevent possible electrolytic damage to the metallic shells of the tube tunnels, destined to connect the Borough of Manhattan and the New Jersey shore, and the Interborough Rapid Transit Company is also proposing to use them for a similar purpose in connection with its tunnels under the East river.

Franklin N. Waterman, New York, did not agree with the conclusions reached by Mr. Knudson, as the data given are not sufficient to warrant such broad statements.

Mr. Rhodes shows that earth currents can be substantially eliminated by proper care of the return system. To do this by means of copper return feeders would often be found impracticable on account of the cost. The natural result, in the cases where remedies are necessary, is the negative booster. It gives the means, with reasonable watchfulness, of determining the distribution of current in a network. The paper, dealing as it does only with the single trolley line, naturally does not bring that out. It shows the enormous gain in respect to reduction of earth currents, but does not show the other possibility of the negative booster, namely, the determination of the distribution of the return current in the network, which is a feature in many cases of very great value, particularly in making it possible to reduce to a minimum the track drops in those regions where current, which has escaped to the earth, is returning to the rails.

Paul Winsor said in Boston, in certain places the conditions are bad and some trouble has taken place near the Harvard power station, where there is a marsh of salt water, and beyond which, about a mile away, is the first car track. There is in the vicinity a large number of water mains, but a careful study of the situation has reduced the trouble most materially. The telephone companies have taken great pains to survey their cables, and when they find a place where they think there is danger of electrolysis they take the matter up with the railroad engineers, who put in a negative feeder or connection to the rail, as may be best, and thus get over the trouble. The railroad has cut its own cables in many places and made special connections and thus got rid of the trouble. The Metropolitan Water and Sewerage Board have large pipes out in the Cambridge section. The railroad studied the matter carefully and introduced eleven insulated joints in these pipes. Some of the joints are rubber and some are wood.

John W. Corning, by means of maps and diagrams, explained the method by which the electrolytic troubles were avoided in Boston. Certain sections were supplied from one power station by current from a machine placed in three-wire relation with the rest of the power station; that is, the power was supplied to the trolley wire from the negative pole of the machine, and the positive pole was grounded. No change was made in the feeder sections; they were simply turned over in polarity without any change except the installation of an additional set of insulating joints in the trolley wire at the points of intersection of positive and negative sections. An electrical survey was then made of the system and showed a reduction of eighty-five per cent in the leakage current.

A communication from S. M. Kintner was read, which quoted from an article on alternating-current electrolysis, published in the *Electric Club Journal* of November, 1905. It was found from tests that, at twenty-five cycles, the effect was negligible, as it was less than one per cent of that caused by direct current under similar conditions. The conditions assumed by Mr. Hayden are very unlikely to exist in actual service. He found it required about 260 volts to force only thirty amperes between two terminals each of twenty square feet of surface, with the terminals only six feet apart and the earth exceedingly moist from impure water. Another test with similar-sized terminals placed in a less favorable location gave only about seven amperes for 260 volts.

Calvert Townley thinks engineers have been unduly fearful of the electrolysis problem. It should be no more difficult of solution than the ordinary questions met every day. Telephone companies, in the protection of lead sheathing cables from continuous-current electrolysis, have adopted a plan which they believe is entirely satisfactory and sufficient. They connect the lead sheath of the cable, where the cable is positive to the return circuit, with a metallic conductor or bond, so that the differences of potential between these two conductors is practically eliminated. They do not pay any attention to the sheath where it bears a negative relation to the return current. The tendency to flow out of the pipe is not concentrated

to one particular point. There will be an area, a positive area, through all of which area there will be a tendency of the current to flow from the sheath to the rail, but it is not necessary to bond the two conductors together at every point in the area. Some central point is selected and the bond inserted there. Consequently the tendency to flow is not entirely removed altogether, but it is removed to such a degree that electrolytic action is practically nullified.

George F. Sever referred to the difficulty of obtaining any satisfactory legal settlement of electrolysis disputes, and described experiments in alternating-current electrolysis at sixty cycles conducted at Columbia University several years ago. Where actual damage from electrolysis does take place it is generally due to the neglect of the engineer of the system whose pipes are injured to adopt recognized precautions.

A. F. Ganz, Hoboken, N. J., called attention to a point brought out in Mr. Rhodes' paper—the fact that the disposition of return feeder copper is quite as important as its weight. The calculations given show clearly that the way to secure a minimum of stray current from the grounded rails of a single-trolley electric road is to insulate the negative bus-bar, and to employ two or more insulated return feeders, either so proportioned in resistance or provided with negative boosters as to produce equal potentials at their connecting points to the rails. This method results in minimizing the potential differences in the rails, and for this reason also minimizes stray currents from the rails.

The question of electrolysis from stray railway currents has been very carefully investigated in Germany by a committee of the German Society of Gas and Water Engineers, who have already issued three annual reports. Translations of these reports for the years 1904 and 1905 are published in abstract in the Report on Electrolysis of the American Gas Light Association. The German committee have formulated a set of rules for electric trolley roads which are designed to prevent trouble from electrolysis due to stray currents. These rules require permanent bonding of the rails so that the resistance of the finished track does not exceed the resistance of an equivalent unjointed track by more than twenty per cent. They also require that the resistance between the rail return and the ground be made as great as possible, and to this end forbid the deliberate grounding of the negative bus-bar and of any part of the return system. They also forbid the bonding of the rails to any underground pipes or other metals. Great stress is laid in these rules upon the installation of return feeders in such a manner as to minimize the rail potentials.

C. P. Steinmetz said the popular conception of electrolysis is rather mixed, and unfortunately, by a reaction therefrom, engineers are liable to overlook some features of the problem and mainly consider only that side which is of popular interest—that is, the destruction of gas and water pipes or bridge piers and such things in the soil. Fortunately, iron is a material which is rather stable and least attacked by electrolytic action; even wrought iron is not attacked very badly, steel very much less, and those iron carbides and silocides called cast-iron are hardly attacked at all. The problem of protection against electrolysis is not the problem of protecting the rails or gas in water pipes. They can very well look out for themselves, and with the reasonable use of negative feeders there is no danger with them. It is in the case of the lead cables of the telephone system that there is the greatest danger of electrolytic action. Electrolysis, due to stray current, is most destructive on lead. The underground metal structures which are suffering most are the underground lead cables, and there again it is the telephone cables. The high-power cables are relatively little affected, because, first, they are better protected in subways, conduits, manholes, etc., and furthermore it is not economical to let a power cable lie idle, and as long as it carries current it is at a temperature above ground, and condensation is not likely to occur at or near such cables, but it does occur at or near a telephone cable. The telephone cable is exposed to the electrolytic attack. The telephone companies have secured protection by maintaining the cable negative against the ground, by connecting to the negative terminal of the system. This protection is not secured by preventing any current from passing between the lead cable and the rail. That can not be done, but the protection is perfect and absolute by making the cable throughout its whole extension more negative than the surrounding ground. As long as the lead cable armor is maintained at a potential, however slight, negative against the ground, though current may pass, there will be no electrolytic corrosion. Where no ground is used at the negative pole of the dynamo, by having negative feeders which lead to the lead cables the whole cable system may be maintained at a negative potential against ground, and even with a limited number of connections between the cable and negative terminal the cable may be protected absolutely, not merely partially.

It has been stated in the discussion that alternating-current electrolysis does not need to be feared, because it is only one-half per cent, or even less, of direct-current electrolytic action. Those who know about the electrolytic attack and the danger of it to lead cables say that in many cases of telephone cables an electrolytic corrosion, amounting to one-half per cent, of the direct-current action would be disruptive in a very short time of the lead cable, and entirely unpermissible. It is feared by those responsible for the maintenance of lead structures that even with the greatly reduced electrolytic corrosion, due to the alternating current, the corrosion will still be destructive and harmful to the telephone cables, because it did not seem possible to protect against it. However, Mr. Hayden says that even against alternating current lead cables can be protected, but this protection should not be necessary, except in extreme cases, because the corrosion is a very small one. Nevertheless, even with half a per cent of the direct-current electrolysis, the thin cable sheet would be eaten through at a fairly high current density in entirely too rapid a time to be permissible.

Dr. Steinmetz does not agree with the statement that the current densities are not high. It will rarely happen that the current density will be uniform throughout the sheath. It will generally be more or less concentrated in spots and the density may really become high. Investigation along the same lines suggested in Mr. Rhodes' paper may well be carried out and will result in an intelligent protection of the lead cable system against alternating-current electrolysis.

By keeping the potential difference between rail and ground in the return circuit below one volt there will be no trouble from electrolysis, because that is less than the decomposition voltage of water. The recommendation of the German engineers is not quite practicable, because one volt potential difference is impossible. In England the specifications have been intended to restrict the drop in the rail return to seven volts. Those who have figured on negative feeders for any railway systems know how handicapped the electrical railroads are by this specification. To restrict it to one volt would appear ridiculous. A more sensible specification would be not to specify return drop, but to specify that the underground iron structures, which are desirable for protection, must be made negative and maintained negative against the rail. If all the water and gas pipes are connected to the negative terminal of the dynamo, and maintained negative, that is a complete protection for them. Everything can be maintained by making it negative, and the question of electrolysis of outside structures need no longer be considered.

The Mechanical Equipment of the Hotel Knickerbocker.

One of the Most Modern Hotel Buildings in the World.

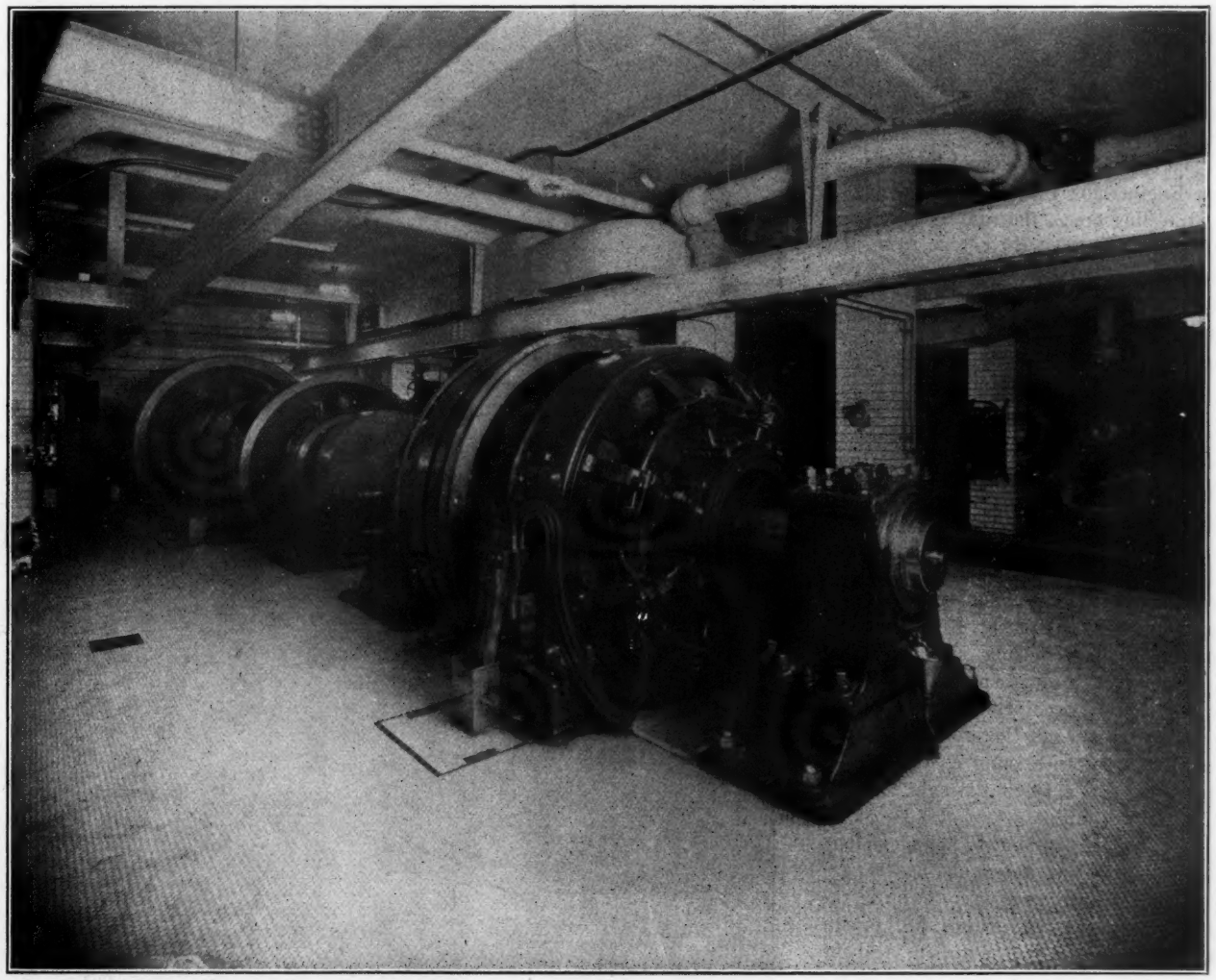
A FEW months ago there was opened in New York city at the corner of Broadway and Forty-second street the Hotel Knickerbocker, at once the most striking example of modern excellence in appointments looking to the comfort and convenience of its guests and in the completeness of its mechanical and electrical equipment.

The accompanying illustrations will give some idea of the appearance and arrangement of the apparatus. The engine room, which includes the generating apparatus, switchboards, storage battery, pumps, refrigerating machines, compressers and oiling system, is located in the sub-basement, the engineer's office being located in a mezzanine gallery overlooking the engine room. The boiler room is adjacent to and on the same level as the engine room, as is also a well-equipped machine shop for making complete repairs to any part of the equipment.

The generators are 150, 200, 250 and 300 kilowatts respectively, built by the Sprague Electric Company, and driven by direct-connected Fleming four-valve engines. As may be seen from the view of the engine room given herewith, the arrangement of these generating units is such that ample room is afforded for the attendants to reach any part of the mechanism without difficulty. Each unit is guarded by a two-inch polished brass railing and the flywheel of each engine is shrouded by a Russia iron covering, eliminating entirely any possibility of spraying oil or catching in the clothing of the attendants.

The generators deliver direct current at 110 volts, the running load being about 3,000 amperes, the service including eight and sixteen candle-power incandescent lamps, arc lamps and motors.

The multiple-conductor cables from the generators are carried to the back of the switchboard in conduits laid beneath the engine room floor. The switchboard is made in two sections, the power and distribution panels respectively being separated by a steel and brick column. The illustrations herewith indicate the arrangement of the apparatus. The switchboard is of white marble, set in polished copper stamped frames, and each section is mounted upon seven bronze pedestals. The first panel, at the left, of the power switchboard, is equipped with six solenoid switches, which are operated from the hotel office. These switches control the



VIEW IN ENGINE ROOM OF THE HOTEL KNICKERBOCKER, NEW YORK CITY.

circuits feeding the lights under and over the portico and the office and lobby lights. Upon the other panels are mounted the main generator switches, field rheostat handles, ammeters, a differential voltmeter, Bristol recording voltmeter, Thomson recording wattmeters—one for the total lighting load and one for the total power load—and a point switch for closing the circuits between the differential voltmeter and the positive and negative ground, the four generators and the power and lighting buses.

The other section of the switchboard for the distributing feeder switches is identical with that just described. All the power circuits are protected with automatic underload and overload circuit-breakers. For the lighting circuits there are forty-two double-pole switches, ranging in capacity from 100 to 800 amperes.

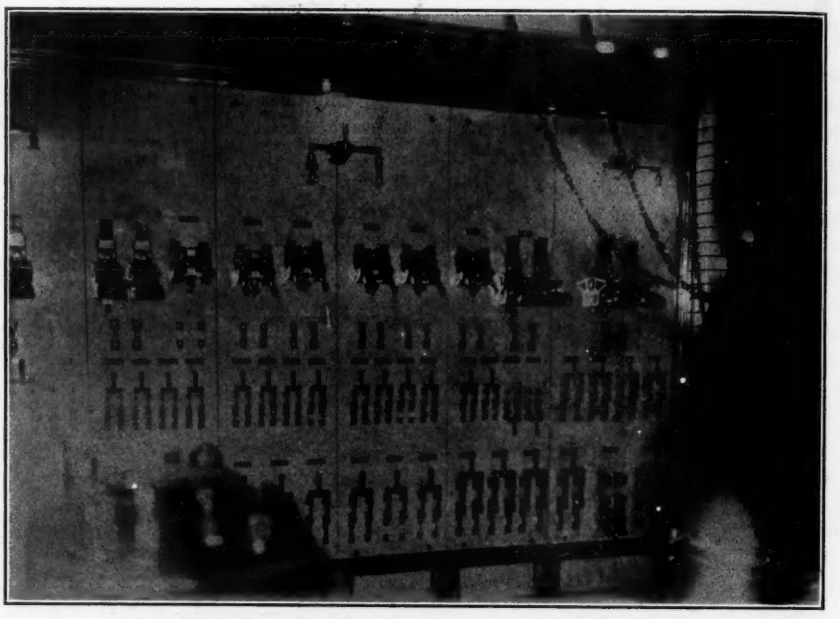
The engine room is served by a Northern Engineering Company's hand-operated traveling crane, the runway traversing the entire length of the engine room, the crane having a lifting capacity of 18,000 pounds. The room is well lighted with arc and incandescent lamps and is equipped with the most modern emergency and safety apparatus.

In the northwest corner of the engine room there is located a storage battery of twenty cells of the National Battery Company's unit type. These cells are divided into four sections and furnish current at eight and sixteen volts for the elevator annunciators, maids' calls and watchman's time detector service. The storage battery equipment is enclosed in a metal and glass housing, and the fumes are carried off through special vents. The low-voltage service includes three motor-generator sets and low-voltage switchboard, the batteries being charged direct from the power buses through the medium of resistances.

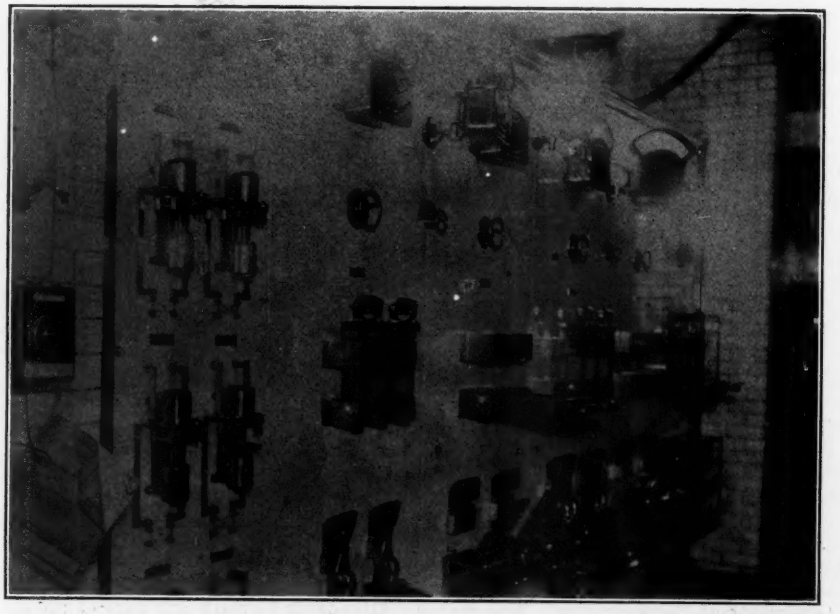
The boiler equipment includes four Babcock & Wilcox water-tube boilers, aggregating 1,400 horse-power. The working pressure is 125 pounds per square inch, and the coal consumption is about twenty-eight tons per day. Coal is received from the sidewalk into a bin having a storage capacity of 200 tons. The furnaces are served by a bucket and chain industrial trolley, the ashes being removed by the same system. The buckets have a capacity of 500 pounds each, and the system was installed by the Northern Engineering Company, of Detroit, Mich. The furnaces are provided with forced draft on the Wing turbine system.

From the boilers the steam is delivered to a twenty-four-inch main header, three lines of piping being taken off from this header. From these branches eight and ten-inch lines are taken to each pair of engines. Each branch is equipped with a valve at the point where it leaves the main header, at the point where the second branch is taken off and at the steam chest of the engine. The various pumps and refrigerating engines are fed by direct lines from the boilers. These are, however, also connected into the main header. All of the engines and pumps exhaust into a main line, which passes the exhaust steam through a Utility muffler and grease extractor.

The ventilating system includes seven blowers in the sub-basement, one exhaust fan on the third floor and three exhaust fans on the roof. The accompanying illustration shows the blower room in the sub-basement. These blowers are driven by Sprague Electric Company type D motors, which are of seven, eight, twelve, fourteen, fifteen, eighteen and twenty-five horse-power respectively. These motors are all controlled by automatic speed-controllers and starting boxes.



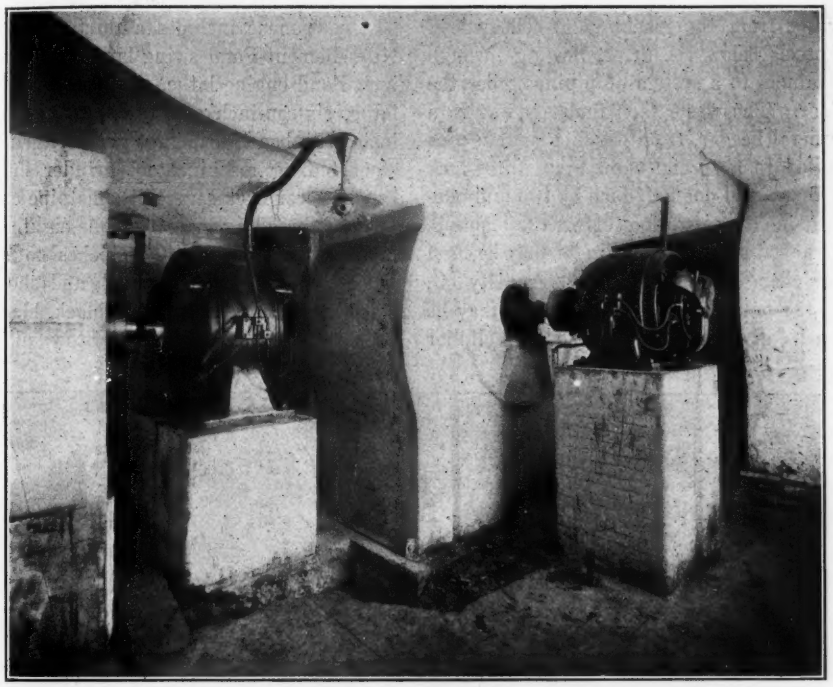
Distributing Switchboard, Hotel Knickerbocker, New York City.



Power Switchboard, Hotel Knickerbocker, New York City.

The pumping plant of the Hotel Knickerbocker is especially interesting because it is the first equipment of single pumps installed in any large modern

building in New York city. Of the thirty-four pumps, twenty-eight are of the single-cylinder type, two are of the duplex type, of which one is a six-inch by four-inch by six-inch vertical pump, and one a five hundred-gallon Underwriters fire pump. There are also four electrically driven centrifugal sump pit pumps, operated by Crocker-Wheeler vertical motors. Every service in the hotel is in duplicate, or has a relay pump, allowing any unit to be shut down at any time. The eleven hydraulic plunger elevators are operated by three eighteen-inch and twenty-eight-inch by thirteen by twenty-four-inch American compound single pumps, outside centre packed plunger type, each having a capacity of 650 gallons of water per minute, operating against a pressure of 160 pounds. This equipment is termed a three-unit layout, one pump being in operation when the load is light and two when full load service is required, leaving one unit as a relay. This is the most economical form of installation, occupying less space and costing less than two units each of maximum capacity. Obviously the operating expense is also less.



BLOWER ROOM, HOTEL KNICKERBOCKER, NEW YORK CITY.

VIEW OF REFRIGERATING APPARATUS, HOTEL KNICKERBOCKER, NEW YORK CITY.

The water for the house service is supplied by twelve-inch and twenty-inch by eleven-inch by twenty-inch American compound packed piston type pumps in duplicate, each having a capacity of 450 gallons of water per minute against 150 pounds pressure. These are cross-connected with the fire pump, so that either or both can be used as fire pumps, and any one of the three can be used on the hot or cold water house service.

The high service brine pumps are of the Marsh single-cylinder type, size seven and one-half inches by four and one-half inches by ten inches, and are in duplicate. The low service brine pumps are American type, size ten inches by eight inches by twelve inches, and are three in number, one or two being used as occasion requires.

The circulating pump for the ice-making tank is a four-inch by six-inch by eight-inch Marsh.

The boiler feed service is supplied by four seven and one-half-inch by four and one-half-inch by ten-inch and four ten-inch by six-inch by twelve-inch Marsh pumps. Two of the former are arranged in relay for supplying the make-up water to the boilers, and two are arranged for handling the water from the high or low-pressure drip tanks, and also for taking care of the blow-off tank. The ten-inch by six-inch by twelve-inch pumps return the condensation from the heating system to the boilers and are also cross-connected to act as the relays on the drip tanks. All the return water is passed through an enclosed Berryman feed water heater, delivering water to the boilers at 210 degrees. The Johnson service system of heat regulation installed in the building is operated by Marsh six-inch by eight-inch by eight-inch air-compressors in duplicate, and air for the elevator and house tanks is supplied by a Marsh ten-inch by eight-inch and four-inch by twelve-inch two-stage air-compressor, which is especially adapted for delivering air at high pressure.

A Marsh six-inch by four-inch by eight-inch air-compressor supplies the air for elevating beer from the ice-boxes in the basement to the various bars.

The pneumatic tube service is supplied with air from a sixteen-inch by thirty-inch by twenty-four-inch low-service compressor, and this plant also is in duplicate.

The vacuum cleaning system installed in the building is also supplied with sin-

gle-cylinder, double-acting, motor-driven vacuum pumps.

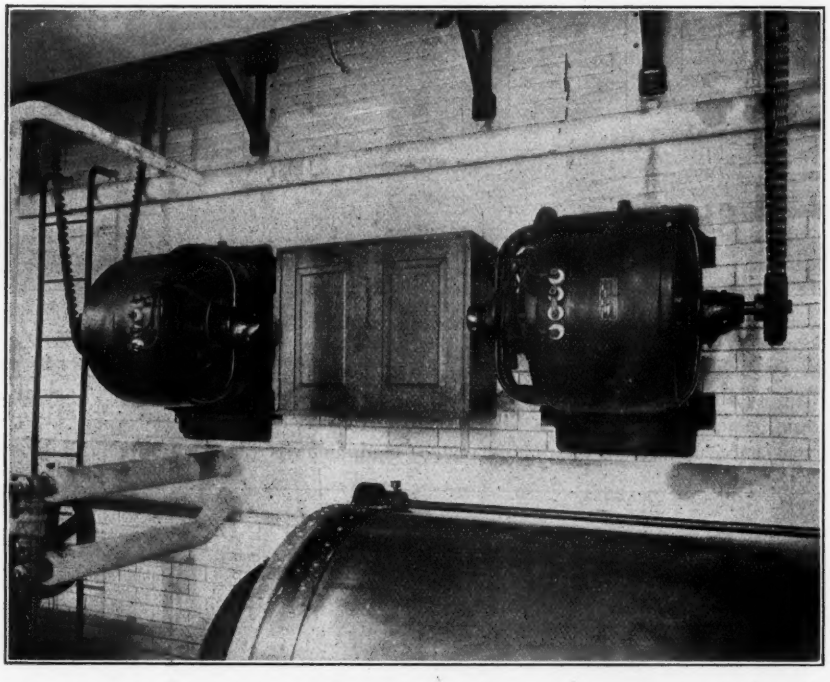
The Marsh and American pumps are manufactured by the American Steam Pump Company, of Battle Creek, Mich., the American being one of the latest products in the line of single pumps and differing from the Marsh only in the fact that it has an outside valve gear controlled by an auxiliary valve, which controls the main steam valves of the pump. Both types are equipped with the most approved form of piston valves and are very economical in operation. The Marsh pump has no outside gearing, and therefore has no necessity for a long yoke. This feature makes it a very compact pump and suitable for modern engine room construction where space is an important item.

The refrigerating plant includes two forty-five-ton machines and one three-ton machine. One of the forty-five-ton machines will handle the entire refrigerating of the house, and the three-ton machine is for very low temperatures for making ice-cream, etc., leaving one of the forty-five-ton machines as a reserve. The ice capacity in cakes is eight tons per day, about one ton being used in caraffes, and special forms for serving grape fruit. The ice is crushed or cut in cubes for table service by electrically driven machines. The refrigerating apparatus was installed by the York Manufacturing Company.

There are eleven passenger elevators of the Standard Plunger Elevator Company's type. The pumps for these elevators have already been described. The elevator discharge tank has a capacity of 15,000 gallons. The three 160-pound pressure tanks are by-passed so that any part of the system can be repaired or cleaned. The drilling for these elevators was all through solid rock, two of them going 233 feet below the street level. In addition to the passenger elevators there are four electrically driven long-run plunger elevators especially designed for this equipment by the Standard Plunger Elevator Company.

The oiling system in operation in this engine room is decidedly unique, and is the result of the ingenuity of the chief engineer, J. Hutchinson. Two four-barrel tanks elevated above the engine room carry the oil supply for the entire equipment. Below and between the two tanks is a small brine cooler, in which there is a coil through which the oil flows by gravity to the distributing system. The main oil line is one and one-half inches in diameter, and this is reduced to a one-inch line, going to the different parts of the engine room. From this one-inch line, one-quarter-inch and one-eighth-inch brass pipes lead to the oil cups on the engines and pumps. All the waste from the machines is collected in funnels below the drips, flowing through strainers to a system of piping under the floor. The waste then finds its way to a general header, from which a suction pipe is led to a special solid brass three-inch and two-and-one-half-inch by two-and-one-half-inch by two-inch Marsh oil pump, arranged so that one cylinder may be used for clean oil and the other for dirty oil, at the same time, or one cylinder may be used for engine oil and one for cylinder oil. This pump has, therefore, two oil ends and one steam cylinder in the centre. One end takes the waste from the general header and forces it through two 150-gallon Hall filters, returning it in a clean condition to the oil tanks described above. For cylinder lubrication there is a sixty-gallon reservoir, elevated so as to allow a convenient steam connection underneath which forces the cylinder oil to the regulation sight-feed oil cups on the engines through an overhead distributing system. All cylinders are equipped with regulation pint lubricators, which may be worked independently of the central oiling system should an emergency make this desirable. At essential points in the engine room brass sinks are located, where a supply of oil is delivered from the overhead system, the waste from these sinks also being connected to the general header just described.

The plant includes a very complete machine shop for making extensive repairs. The equipment includes a thirty-six-inch Niles-Bement-Pond swing lathe, fourteen-inch Pond engine lathe, six-inch jewelers' lathe, sixteen-inch crank shaper, twenty-inch drill, bench drill, wet grinder, grindstone, buffing machine, tool grinder, Fairbanks power hack saw, Williams pipe cutter and threading machines, one-eighth to two inches, and one two inches to six inches, Fairbanks hand punch and shear, blacksmith's forge, swedging block, blacksmith's horn and portable Stow plant for buffing or drilling. The machine shop is driven by a seven-and-one-half-horse-power Sprague motor, belted to a line shaft, and the drills and several smaller tools are driven by three-horse-power Sprague round-type motors.



WALL MOTORS DRIVING WASHING MACHINES, HOTEL KNICKERBOCKER, NEW YORK CITY.

The hotel laundry room is equipped with motor-driven machines of various types. The accompanying illustration shows three of the washing machines, driven by Sprague type D, twelve-horse-power, side-wall motors. There is also a laundry machine on the thirteenth floor, driven by a Sprague one-half-horse-power, round-type motor. The following apparatus in the laundry room is also motor-driven: two mangles and four extractors operated by Watson motors built by the Mechanical Appliance Company, Milwau-

kee, Wis.; one tumbler, a bosom press, body ironer, collar and cuff ironer, band ironer and several smaller appliances.

The fire-alarm service is very complete and consists of indicators located in the office and in the engine room, giving an immediate alarm in case of fire. When a fire-alarm is turned in, a large gong is sounded in each elevator shaft. The elevator attendants immediately proceed to the sub-basement. The engine-room operators, under the direction of the chief engineer, secure the proper fire-fighting appliances, and, upon receiving the designation from the automatic annunciators, proceed to the point of emergency. The fire drill, which is part of the regular work of the engine-room organization, has been carried out very successfully.

The hotel is equipped with a complete system of vacuum cleaning, the electrically driven suction machines being located in the engine room, and the cleaners operated by means of hose connections and outlets on each floor.

For the dumbwaiter service there is a series of push-buttons, which give a signal to a central station. The operator at the central station has complete control over the dumbwaiter service.

On each floor of the building there is a room clerk's desk, this clerk having charge of distributing the mail, which is sent to the floor through a complete pneumatic tube service.

Outside of each door there is located a socket, into which the maid plugs a small incandescent lamp, indicating the room in which she is at work. This facilitates the calling of the maid either from the office or from any of the rooms through the medium of the room clerk on each of the floors.

Telephone instruments are located in every room, the New York Telephone Company having a very complete switchboard installation in the office of the hotel.

One of the illustrations herewith gives a view of the engineer's office, located on a mezzanine gallery overlooking the engine room. The engineer's equipment in this office includes a handsome white marble gauge board, upon which are mounted registers for the entire water system and steam and electrical plants. A complete outfit of electrical and steam test apparatus, a watchman's time detector clock and eight master clocks for the time circuits installed throughout the building, and facilities for filing records of every description are also included in this equipment. The chief engineer, J. Hutchinson, has entire charge of the mechanical equipment of the building. Under his direction there are about fifty-two employés, these including engineers, electricians, carpenters and plumbers.

Chief Engineer and Assistants, Hotel Knickerbocker, New York City.

The architects for the building were Trowbridge & Livingston. The entire elevator equipment was installed by the Standard Plunger Elevator Company, New York city. The pumping plant was installed by Montgomery & Company, of New York city, agents for the American Steam Pump Company, under the direction of T. E. Morford. The refrigerating plant was installed by the York Manufacturing Company, York, Pa., under the direction of George Langdon, E. M. Freedman acting as consulting engineer. The ventilating apparatus was installed by G. A. Suter & Company. The generators were installed by G. E. & A. L. Pennock, and the wiring for the switchboard was done by the Lord Electric Company, New York city. Pattison Brothers acted as consulting engineers on the electrical work, and the Emergency Engineering Company, New York, fitted up the machine shop and engine guards.

A New Mercury Vapor Lamp.

A new form of mercury vapor lamp has been brought out at Paris by the Compagnie Générale d'Electricité. It is the invention of Omar Bastian, and has some interesting features. The new lamp consists of an upper metallic hood somewhat like that of an arc lamp. Below this is suspended the mercury vapor tube and below the latter an incandescent lamp. The use of the incandescent lamp is to give the red rays which are absent in the mercury vapor lamp, and such a combination has already proved to be successful in some of the preceding types. The mercury vapor tube is made in S-form, and it is provided with an electromagnetic tripping device whereby it is inclined at the time of throwing on the current so as to start the lamp running. In this connection is used a resistance which is lodged in the hood and prevents the current from rising too high when the lamp is started. When the current is thrown on, it reaches several amperes, but as soon as the lamp is well running, which is about one minute, the current falls to 0.6 amperes. A new arc lamp known as the "Helia" is now manufactured in Cologne, Germany, by the Regina Company. It is built for all sizes ranging up to a thousand candle-power, and runs upon 110 volts. What is to be noted is the small amount of current used in the present lamp, which is 3.5 amperes, as compared with the usual ten-ampere lamp, and it is claimed to give the same candle-power in this case. It will run for sixty hours with the same upper carbon, and the remainder of this can be used again to form the lower carbon, so that there will be no waste in the lamp. The regulating device is very simple, and contains practically no mechanism to get out of order. Placed in an all-enclosed globe it gives a steady and noiseless light, and is specially adapted for running on alternating current.

How to Remedy the Effects of Foreign Current on Automatic Block Signals.

At the meeting of the Railway Signal Association, held in New York city, January 8, the committee on "How to Remedy the Effect of Foreign Current on Automatic Block Signals," presented an elaborate series of questions and answers bearing upon this matter. These have been analyzed and the committee, upon this analysis embodied in its report the following recommendations:

For a proposed law which was submitted to the association for recommendation:

The Board of Railroad Commissioners shall, whenever in its judgment the public safety requires the erection of interlocking switch and signal devices at points where steam and electric street surface railroads intersect at grade, direct the erection of such interlocking switch and signal devices in such a manner as shall least interfere with the safe operation of the railroad whose tracks are crossed, and shall direct that the expense of such erection shall be borne by the road seeking to make such crossing.

If this recommendation should be made a law of any state, each crossing case would have to be taken up with the state commission, separately, to have the commission rule that the crossing shall be made and protected in the manner covered in proposed recommendations for an agreement between the two roads.

In the matter of an electric road seeking permission to cross at grade the tracks of a steam road, it is proposed that the association recommends to general managers that the following requirements be made a part of the agreement to be executed covering the installation, maintenance and use of the crossing by the electric road:

First—That the electric road covenants and agrees that the steam railroad may and the steam railroad on its part further covenants and agrees that it will, at the sole cost and expense of the electric road, furnish and at the crossing erect and install in conformity to the plans, specifications and requirements of the signal engineer of the steam railroad company, an interlocking plant with derails, machinery, apparatus and appurtenances as said signal engineer may require, and connect the same with every track of said steam railroad, then there being, or which should be subsequently there laid.

Second—Each track of the electric road must be properly bonded and provided with a 500,000-circular-mil return conductor cable which is to be connected to each frog and to each rail of the electric road for a distance of 100 feet on each side of the tracks of the steam road and shall be connected to the separate return conductor of the electric road if one is used.

Third—The return conductor provided by the electric road shall be of such capacity that the potential of the traction return current, when measured between the crossing rails and the track circuit rails of the steam railroad shall not exceed two volts.

Fourth—Insulation of the type and arrangement required by the signal engineer of the steam railroad shall be provided by the steam road at the expense of the electric road, between the rails of the crossing frogs and the track circuit rails of the steam railroad.

Fifth—All wires of the electric road charged with power currents must be supported in the manner and given the clearance from the tracks, the telegraph, the telephone and the signal wires of the steam railroad that is required by the signal engineer of the steam railroad.

Sixth—Protection nets, bridges or other supports of the design, strength and arrangement required by the signal engineer of the steam railroad must be supplied by the electric line for all wires charged with current from 500 to 11,000 volts which cross the tracks or wire lines of the steam railroad. Nets or bridges are not recommended for power transmission lines charged with current of over 11,000 volts.

Seventh—In case the electric road shall fail to promptly make all repairs and renewals to said return connections, power wires and protection nets or bridges, when in the judgment of the signal engineer of the steam railroad the same shall be necessary, in such event, the steam railroad may, after giving ten days' notice in writing, make such repairs and renewals, and the electric road shall pay to the steam railroad at the end of the month in which such repairs were made, the entire amount of all such expenditures.

Eighth—That the electric road shall bear and pay any and all loss or damage to its own property, or to the property in its custody, or to its employés or passengers, or the property of the employés or the passengers on the steam railroad arising from any defect in said interlocking plant or its appurtenances, said return connections and power wires, or from any act or neglect of its own employés; or arising from any cause, the responsibility for which can not be determined; and the electric road shall, and hereby agrees that it will, indemnify the other against any liability, claim or recovery from any loss, cost or damage whatsoever, arising from or growing out of any accident or casualty caused as aforesaid to persons or property.

Ninth—That all loss or damage to the property or employés of the steam railroad, or to persons or property in the charge of the steam railroad as a carrier or otherwise, which shall arise from or grow out of any act or neglect of the employés of the electric road or shall result from wrong working of automatic and interlocking signals on the steam railroad, which it can be shown has occurred through current escaping from the electric road, shall be wholly borne and paid by the said electric road.

Under "methods of protection" against foreign current interfering with the working of automatic signals, the committee submit the following conclusions for adoption by the association:

1. When there is a crossing of an electric road with a steam road, batteries must be placed at each end of steam road track next to crossing and battery current arranged to flow in direction with foreign current leading into track circuit, if foreign current is found to flow in a definite direction. The connections, through block section for control of signals, must be made by means of line wire circuits.

If there is sufficient foreign current to improperly work the track relay when an insulated joint is broken down, the multiple track relay arrangement should be used.

2. For situations where there are powerhouses and foreign currents follow the track rails, although there may not be a crossing or connection with an electric road, it is recommended that the conditions be carefully studied and exact information obtained as to the source, direction, amount and pressure of foreign current, and provision should then be made for removing or blocking out this current.

3. To minimize as far as possible the effects of foreign current on line wire circuits, it is regarded as important that trunking be kept above the top of the ground, the rubber and other insulations be kept in first-class condition and the common wire limited to a length of ten miles.

4. For multiple arrangement of track circuit relays, a resistance of sixteen ohms is suggested for relay at battery end and four ohms for the relay at the other end of track circuit. The committee recommends that further research be made to establish the proper relation of the resistance, pick up and releasing point of the two relays of the multiple track circuit arrangement.

5. For track circuits having but one relay, a resistance of nine ohms is recommended for circuits 500 feet and under, and a resistance of four ohms for circuits of greater length than 500 feet.

While it is recognized that the best results are to be obtained by using a relay having a resistance proportioned to the resistance of the circuit, the benefits do not compensate for the disadvantage, from a maintenance standpoint, of having to keep in stock track relays of a number of different resistances.

6. It is advisable to thickly coat with a heavy oil the parts of an insulated joint before the joint is put in place.

If there is interference from foreign current it is advisable to put a heavy oil on the joint and particularly around the exposed ends of the fibre at least every two months.

7. For direct-current track circuit connections run in trunking, No. 8 or larger B. & S. gauge soft drawn copper wire with three-thirty-seconds-inch rubber insulation wall is recommended.

8. For signal circuit connections run in trunking a No. 12 or larger B. & S. gauge, soft drawn copper wire with five-sixty-fourths-inch rubber insulation wall is recommended.

9. Trunking when run parallel with the track should be kept clear of the ground.

When run across tracks, trunking should be put in with top clear of the ballast and with top of capping not less than one-half inch below bottom of rail.

10. The standard ground should be made by burying in moist earth an annealed copper plate one-sixteenth-inch thick, two feet square, to which has been brazed for a length of twelve inches, a No. 4 B. & S. gauge soft drawn bare copper wire. The plate to be buried in clay or in a six-inch layer of fine charcoal and the connecting wire is not to exceed 150 feet in length. The effectiveness of the ground should be tested by a Wheatstone bridge.

W. H. ELLIOTT, Chairman.
C. C. ANTHONY,
AZEL AMES, JR.,
C. C. ROSENBERG,
Committee.

This report was discussed at length, without, however, arriving at a decision. The subject will probably come up for consideration at the annual meeting, which will be held in Milwaukee, Wis., October 8-10, when a vote may be taken.

The Societa Hidroelectrica del Guadiero 50,000-Volts Development.

One of the large hydraulic plants to be erected shortly in Spain is the station which will be used to give the city of Seville a source of current. A pole line of about eighty miles in length will give the power transmission from the falls of the Guadiaro river to the city. The plant, for which the electric outfit will be furnished by the Oerlikon Company, is controlled by the Societa Hidroelectrica del Guadiero. A high voltage, 50,000-volts, three-phase current, will be employed in this case, and it will be one of the highest voltages used on the Continent. As regards the outfit to be placed in the turbine house, it consists of three alternators of the Oerlikon three-phase pattern which are designed to give 1,500 kilowatts. These alternators work at 5,000 volts and forty cycles, running at 400 revolutions per minute. The total capacity of the plant is thus 4,500 kilowatts. Direct coupling is used for turbines and alternators, and the latter are excited from two smaller direct-current turbine-generators of seventy kilowatts each, working at 100 revolutions per minute. As the line voltage is 52,000 volts at the station, a bank of step-up transformers is used for raising the 5,000 volts of the machines. In this case six single-phase transformers of 600 kilowatts each are used, connected on the delta system. Where the pole line enters Seville there will be a substation of some size for reducing the potential to 2,500 volts.

The Faraday Society.

The twenty-seventh ordinary meeting of the Faraday Society was held on Tuesday, February 19, at the Institution of Electrical Engineers, 92 Victoria street, S. W., London, England. Dr. T. Martin Lowry was in the chair.

Mr. John B. C. Kershaw read a paper entitled, "The Present Position and Future Prospects of the Electrolytic Alkali and Bleach Industry."

The paper opens with a brief historical review. The original patent of Charles Watt for the electrolytic production of sodium or potassium hydrate and chlorine compounds was taken out fifty-five years ago; but the earliest industrial experiments were made in the early eighties, and in 1889 a 200-horse-power plant was erected at Griesheim, using the "elektron" cell, in which the diaphragms are said to be made of cement. This cell is now used extensively on the Continent, and appears to work satisfactorily and economically.

In England the earliest industrial trials were made with an asbestos diaphragm cell at Snodland in 1891-92, and afterwards with a bell type of cell. These experiments led to the formation of the Electrochemical Company at St. Helens, but the works are now closed down. The Hargreaves-Bird and the Castner cells were patented in 1892-93; the Castner Kellner Works were started at Runcorn in 1897.

In America a Le Sueur diaphragm cell was erected in 1892 and a Castner cell at Niagara in 1897-98.

The second part of the paper contains a list of the works now operating in Europe and America, summarizing, as far as information is available, power used, type of cell and process employed, and products made. The totals show that about 55,000 horse-power are now being devoted to the production of alkalies and bleach by the electrolytic method, and that plant representing about 13,000 horse-power is lying in reserve. Assuming that all the plants are being worked to the best advantage, the production of seventy per cent caustic soda at present would be about 110,000 tons per annum, with an equivalent of 231,000 tons of thirty-five per cent bleaching powder (two tons of caustic and 4.2 tons of bleach per estimated horse-power year).

In conclusion the future of the industry is discussed. Within the last few years the electrolytic method appears to have had a setback. In the author's opinion the Le Blanc, electrolytic, and ammonia soda processes will continue to exist side by side. In the case of the first, alkali and bleach will be produced in diminishing quantities, but be compensated for by the sulphur derivatives which will yield the profits. The best of the electrolytic processes will gradually replace the Le Blanc method for the manufacture of chlorine products, and they will also produce metallic sodium and its derivatives. The ammonia soda process will continue to manufacture sodium carbonate and bicarbonate, but it can never replace the other methods, until at any rate it succeeds in making chlorine products from its waste liquors.

Mr. W. Pollard Digby regretted that more information was not available regarding such points of detail as anode consumption, life and efficiency of diaphragms, etc., which would be of general use to those engaged in the smaller electrolytic industries.

Mr. John Rhodin gave some interesting details regarding the early history of the electrolytic processes. He demurred from the author's statement that these were principally developed in Germany, and he attributed the failures in this country to over-capitalization and reckless finance, and not to any lack of skill or knowledge on the scientific side. The future will largely depend on the cost of power production.

Dr. R. Seligman drew attention to some omissions in the author's list of works and products.

Dr. H. Borns, referring to the lack of information regarding diaphragms, thought that magnesite was being used successfully.

Mr. J. C. Richardson also added some interesting historical information. He favored the "bell" type of cell in which an eighty-four per cent efficiency was possible.

International Book and Paper Exposition.

Presses, posters, printed processes and products, photographs, periodicals, papeterie and publicity will be some of the great departments at the International Book and Paper Exposition to be held in Paris from July to November of the present year.

The exposition was authorized by ministerial decree, and will be under the direction of the minister of public instruction and fine arts. The exposition building will be the Grand Palais on the Champs Elysees.

Dr. W. H. Tolman, 287 Fourth avenue, New York city, has been asked by the administration to accept the commissioner-generalship of the American section.

The Proposal of the New York and the New York & New Jersey Telephone Companies for a Monopoly of Service in the Greater City.

The following statement is abstracted from the report of the New York & New Jersey Telephone Company for the year ending December 31, 1906. This report was summarized in the ELECTRICAL REVIEW for March 2.

"The companies operating plants in competition with your company have made no apparent progress during the year, and your company's development has not been appreciably affected by their operations.

"In connection with an application for a franchise to operate a second telephone system in New York city, the board of estimate and apportionment of New York invited a proposal from your company and the New York Telephone Company. In response to this invitation, the companies jointly proposed to the city that, so long as no other public telephone system was established in the city and no other telephone franchises granted, they would:

"(1) Pay to the city annually, to be charged against revenue as a part of operating expenses,

"During the first five years at $116,000 per year.

"During the second five years at $122,000 per year.

"During the third five years at $134,000 per year.

"During the fourth five years at $152,000 per year.

"During the fifth five years at $176,000 per year.

"During each year thereafter at $200,000 per year.

"(2) Furnish such telephone facilities and service within the city as the city might desire for its official use at fifty per cent reduction from the schedule rates.

"(3) File with the city comptroller annually a verified report, audited and certified if desired by public accountants acceptable to or designated by the comptroller, showing, as to their telephone systems: total investment, gross earnings, expenses and net earnings, the various items to be shown under proper classifications and in a form to be agreed upon.

"(4) Adjust their rates from time to time to limit their net earnings to approximately ten per cent on the actual investment of capital, after caring for depreciation.

"The proposal is still pending before the board of estimate and apportionment of New York city."

Methods of Creosote Analysis.[1]

The growing scarcity of lumber, with the consequent high prices, is making it imperative that more attention be paid to preservative processes whereby the time of service of timber may be lengthened. Coal-tar creosote is generally regarded as the most efficient of the wood preservatives. This product is very variable in composition, owing to differences in the coals used and in the methods employed in their distillation. Creosotes of different compositions are believed to have different values as wood preservatives, and an analysis of the oil used is, therefore, important.

No very large amount of study has been directed to perfecting the methods of creosote analysis, and the Forest Service, believing the matter vitally important to the progress of wood preservation, is now carrying on an investigation of these methods.

The most important part of a creosote analysis is the fractional distillation, since by this operation an approximate determination is made of the relative proportions of the most important substances in tar oil. There has been considerable divergence of opinion as to the best way of carrying out the fractionation of tar oils, some recommending a retort as a distilling vessel and certain temperatures for taking fractions, others recommending a distilling flask and a different set of temperatures.

Laboratory experiments carried on by the service have shown that the difference in the weights of the fractions obtained when using different sorts of distilling vessels are not large, but that the composition of the fractions indicate a little better separation by the flask than by the retort. As regards the influence of the rate of distillation, variations of from one to three drops per second have but slight influence on the weights of the fractions, though the slower rate is more satisfactory.

It is commonly believed that the relative amounts of light oil, naphthalene, and anthracene oil are the most important factors determining the value of a creosote for wood preservation. A number of creosotes were very carefully fractioned and determinations made of the amounts of naphthalene and solid anthracene oil distilling between various temperatures. The average of the results shows that at least twenty-five per cent of naphthalene was present in the distillate between 205 degrees and 250 degrees centigrade, and that over twenty-five per cent of anthracene oil solids are present in the distillate above 300 degrees centigrade. Work on the specific gravity and the index of refraction of the distillates between different temperatures is now being carried on.

The desirability of getting the criticisms and suggestions of users of creosote has led to the publication of a detailed account of the methods employed in the experiments and the results which have been obtained. Those who desire the publication should ask for Circular 80, "Fractional Distillation of Coal Tar Creosote." Requests should be made to the Forester, Forest Service, Washington, D. C.

[1] United States Department of Agriculture Forest Service, Trade Bulletin 13.

Annual Dinner of the Harvard Engineering Society.

The ninth annual dinner of the Harvard Engineering Society was held on Saturday evening, March 2, in the Harvard Union. There were 144 persons at the dinner, of which number forty-seven were graduates, representing classes from 1855 to the present day.

Professor L. N. Hollis, chairman of the division of engineering, presided and introduced the following speakers of the evening: G. S. Rice, '70, chief engineer, Rapid Transit Railroad Commission, New York; J. R. Worcester, '82, consulting engineer, Boston; Franklin Remington, '87, president, Foundation Company, New York; F. L. Gilman, '95, chief engineer, Western Electric Company, New York; J. A. Moyer, '99, chief of the computing department, General Electric Company, Lynn; H. M. Hale, '04, assistant engineer, Rapid Transit Railroad Commission, New York.

Before adjourning, a resolution was unanimously adopted to appoint a committee to report not later than Commencement, 1907, on means for effecting a closer affiliation among Harvard men interested in engineering. It is proposed to establish a Harvard Engineering Society in New York city and possibly in other large engineering centres where the number of Harvard graduates interested in engineering may warrant.

The following committee was appointed: Professor L. J. Johnson, chairman; G. S. Rice, F. W. Dean, J. E. Vaughan, F. L. Gilman, H. M. Hale, H. P. Forté.

At the celebration of Washington's Birthday at Lehigh University, South Bethlehem, Pa., the honorary degree of Doctor of Science was conferred on Arthur Arton Hamerschlag, director of the Carnegie Technical Schools, Pittsburg, Pa. The orator of the day was the Honorable W. U. Hensel, of Lancaster, Pa., ex-Attorney General of Pennsylvania.

Power Plant of the Quintard Iron Works Company of New York City.

THE Quintard Iron Works is one of the oldest establishments of its kind in this country and is among the few such remaining in New York city. Its works are made up of two groups of shop buildings, one occupying the major portion of the block bounded by Twelfth street, Avenue D, Eleventh street and Dry Dock street and the other running along the East river front from Tenth to Eleventh street.

The work turned out by these shops is largely of a special nature consisting of heavy and light machine work, special engines and boilers, large condensers, pumps, cement-making machinery, steel stacks and tanks and boat and ship work of almost every kind.

Previous to July, 1906, at which time the new power plant was put in operation, power for the various operations of the shops was obtained partly from the service mains of the New York Edison Company, and partly by means of steam generated at various points throughout the works.

The group of buildings on the river front forming the so-called Eleventh street works of the company, are supplied with electric power by the Edison company, which power is used for driving the various machines in the machine shop and also for operating a traveling crane in this shop.

There is also a steam plant which furnishes steam for driving an air-compressor. This compressed air is used for drilling, riveting and similar operations in the shops, on the dock or on board boats lying alongside the dock. An electrically driven air-compressor is also installed in the machine shop, but is seldom used.

On account of existing laws and ordinances it was found impossible to run electric wires from the new plant located at the other works to the Eleventh street works, therefore no change has been made in the power equipment of the latter.

The Twelfth street works of the company are made up of a boiler shop, an hydraulic flanging and riveting shop, a forge shop, two light machine shops, a heavy machine shop, an experimental and electrical repair shop, a pattern shop, an erecting shop, a three-story office building, a storehouse for patterns and the power plant building. The combined floor area of all of these buildings amounts to approximately 47,000 square feet. In addition there is a driveway running through the works from Eleventh to Twelfth street, and a storage yard on the Twelfth street side of the works.

Power for operating the various machines throughout the Twelfth street works was originally furnished through an extensive system of belting, shafting and gearing from two engines.

One of these, a large horizontal slow-speed machine, was installed in a small one-story building sixty feet long by ten feet wide which occupied a portion of the site of the new power plant. It was supplied with steam from a locomotive type boiler also installed in this same building and fired from the erecting shop, in a portion of which a limited supply of coal was stored.

This engine furnished power for the group of machine shops.

The other engine was installed in one corner of the boiler shop and furnished power for the various machines in that building. This engine was a vertical high-speed machine and received its steam from a vertical boiler installed in one end of the riveting and flanging shop.

This boiler also furnished steam for a simple air-compressor installed alongside the boiler, a duplex air-compressor installed in the boiler shop, a high-pressure pump for the hydraulic machines and a steam hammer in the forge shop.

A third boiler was installed in a shed outside the forge shop but was not much used as inefficient circulation rendered its operation very unsatisfactory. This was a horizontal water tube type of boiler.

POWER-HOUSE, TO RIGHT OF SHOP BUILDING, QUINTARD IRON WORKS COMPANY, NEW YORK CITY.

UPPER FLOOR OF POWER-HOUSE, SHOWING COAL STORAGE, QUINTARD IRON WORKS COMPANY, NEW YORK CITY.

All three of these boilers were interconnected so that two or all could be used in conjunction when necessary.

As these various machines became worn-out with long usage, electric motors were installed at various points throughout the works, power being obtained from the street mains of the Edison company, until finally a semblance of individual electric drive throughout, had been reached.

Because of the air-compressors, the steam hammer and the heating of the office building, however, it was necessary to keep the boilers in operation.

About two years ago the directors of the company decided to centralize their boiler and air-compressor equipment and also to install their own electric generating plant.

The site selected for the power plant

building was a plot of ground facing Eleventh street and about midway between Dry Dock street and Avenue D, thus providing a very central location. The available space was approximately sixty feet deep by thirty-five feet wide and was occupied by two small buildings of very little value. Upon this location a two-story brick, steel and concrete power plant building was erected. The main walls of the building are of brick sixteen inches thick, resting upon foundations of concrete. The total height of the building above the top of the foundations is forty-five feet three inches.

The ground floor consists of a five-inch layer of concrete over which is spread one inch of cement mortar giving a smooth, hard finish. The second floor is of Roebling reenforced cinder concrete construction, the spans being about six feet between floor beams. The uniform load for which the floor was designed is 250 pounds per square foot.

The roof is of similar construction sloping slightly toward the front of the building. The roof purlins consist of eight-inch channels, spaced about four feet apart. These are supported by three trusses. These trusses are built up of angles and plates. Each has a total depth of about four feet and spans the width of the building. The superficial load for which the roof is designed is fifty pounds per square foot.

The main floor of the building is divided by a brick partition wall running across the building, into a boiler room forming the Eleventh street end and an engine room occupying the remainder of the floor. Opening from the erecting shop and passing through the engine room is an entirely enclosed stairway leading to the second floor of the building.

The second floor contains a 100-ton coal storage bin, the boiler flue and the lower portion of the smokestack. It is otherwise left open for use as a storage room or as an additional machine shop.

The coal bin consists of a steel plate box heavily reenforced with I-beams and channels. It is supported upon four built-up columns at the corners, heavy plate girders being placed under each of the two long sides of the bin. The bottom of the bin consists of two pockets made up of seven-sixteenths-inch steel plate, each of which discharges into the fire room through a hopper equipped with a suitable valve. The walls of the bin are made up of five-sixteenths-inch steel plate for the lower third and one-quarter-inch steel plate for the upper two-thirds. Where these two plates unite a reenforcing band consisting of eight-inch, eighteen-pound I-beams is carried completely around the bin. Vertical stiffeners, also consisting of eight-inch, eighteen-pound I-beams are set every four feet and run from top to bottom. The upper and lower edges of the bin are reenforced by means of eight-inch channel beams laid flat. All of these stiffeners are securely riveted to the bin plates and to each other by means of framing angles. In addition to the vertical and horizontal reenforcing of the coal-bin walls these are securely bolted to the supporting beams and girders, the bolts passing through the floor plates and securing them in position. The sides are also tied together at the top by means of angle irons so placed as to effectually prevent any bulging of the sides due to the horizontal outward pressure of the coal. This coal bin and also the smokestack, flue and boiler smoke connections were built and erected by the Quintard Iron Works Company, themselves.

Coal is received in a covered pit in the boiler room into which it passes through a chute running in from the sidewalk. From this pit it is raised by means of an electric motor-driven bucket conveyer and discharged through a chute into the bin above.

A 500-pound coal car runs on rails across the firing floor and directly under the hoppers from the coal bin above, from which it is filled as required. The boilers are fired directly from this car. In this way all coal is kept off the boiler room floor.

There are two boilers set in battery and space is reserved for a third. Each boiler is a Babcock & Wilcox, inclined water-tube, cross drum type, rated at 150 horse-power with inclined wrought steel headers and fourteen-foot tubes. Each is equipped with a superheater designed to raise the temperature of the steam 100 degrees Fahrenheit above that of the saturated steam. The steam pressure for which the boilers were built and at which they were tested is 200 pounds per square inch. The pressure at which they are operated, however, is 150 pounds.

A one-eighth-inch sheet-steel smoke connection passes from the top of each boiler setting at the rear through the second floor and into a common flue made of the same material which runs horizontally along the west wall of the building, just above the second floor level to and into the smokestack which is located at the west side of the building at about the centre.

The smokestack is made up of steel plates riveted together to form a cylindrical stack 107 feet high and four feet in diameter. This stack rests upon and is bolted to a cast-iron base plate which is supported by I-beams forming part of the second floor construction. The total height from the grate bars to the top of the stack is 125 feet.

The thickness of the plates from which the stack is made up is three-eighths-inch for the lower third, one-quarter-inch for the middle third, and three-sixteenths-inch for the upper third.

Eight five-eighths-inch galvanized steel wire rope guy lines are provided for the support of the stack. These are securely anchored to the power plant and shop building.

That portion of the smoke flue and stack which is contained within the second story is encased in No. 12 sheet iron, over which an asbestos covering is applied. The opening around the boiler smoke connections where they pass through the second floor and around the stack where it passes through the roof have been made the full size of the casing so that this space between the stack and the casing forms a very efficient ventilator for the boiler room. A hood is provided around the stack just above the roof which prevents the entrance of rain into this space.

The supply of water for the boilers is obtained from the city water mains in Eleventh street. The service pipe enters the building at the southwest corner where the water meter is located. From the meter it passes across over the boilers and into the engine room where it enters the feed-water heater through an automatic float controlled valve.

The feed-water heater is of the Warren Webster open type, rated at 300 horse-power capacity. It is provided with an oil separator at the steam inlet, with perforated copper trays over which the incoming cold water percolates and mixes with the exhaust steam, with automatic supply and overflow valves, filter bed, settling chamber and thermometer for indicating the temperature of the feed water.

The entire heater is insulated with a magnesia covering one inch thick and the temperature of the feed-water averages as high as 205 to 206 degrees Fahrenheit. A by-pass and also a flushing connection for the filter are also provided.

From the feed-water heater the hot water is delivered to the boiler feed pumps, of which there are two, by means

of a pipe passing through a duct in the engine room floor.

There is an electric motor-driven boiler feed pump installed in the engine room. This is an I. B. Davis, four and one-half-inch by four and three-quarters-inch triplex, single-acting plunger pump driven by a four-horse-power Northern variable-speed motor. By means of a controller placed in the boiler room, which combines both armature and field circuit resistance, the speed of the motor may be varied from 200 to 400 revolutions per minute by armature control and from 400 to 800 revolutions per minute by field control. Power is conveyed from the motor shaft to the eccentric shaft of the pump through two sets of gears, the total speed reduction being such that the eccentric shaft of the pump may be run at any desired speed between five and twenty revolutions per minute corresponding to a delivery of from 300 to 1,200 gallons per hour.

The economy of operation shown by this pump is far in excess of what can be obtained with the more common steam-driven non-fly-wheel type of pump and its convenience of operation as compared with a steam-driven pump is such that the operators much prefer to use it although a steam pump was provided as a spare, and also to be used at times when the electric plant was not running.

This steam-driven pump is installed in the boiler room. It is a Fairbanks-Morse, five and one-quarter-inch by three and one-half-inch by five-inch outside packed duplex plunger type, brass fitted pump and is sufficiently large to supply water to both boilers running at full load if necessary.

The two pumps deliver into a common feed line from which a branch line is carried up to each boiler through the customary stop and check valves.

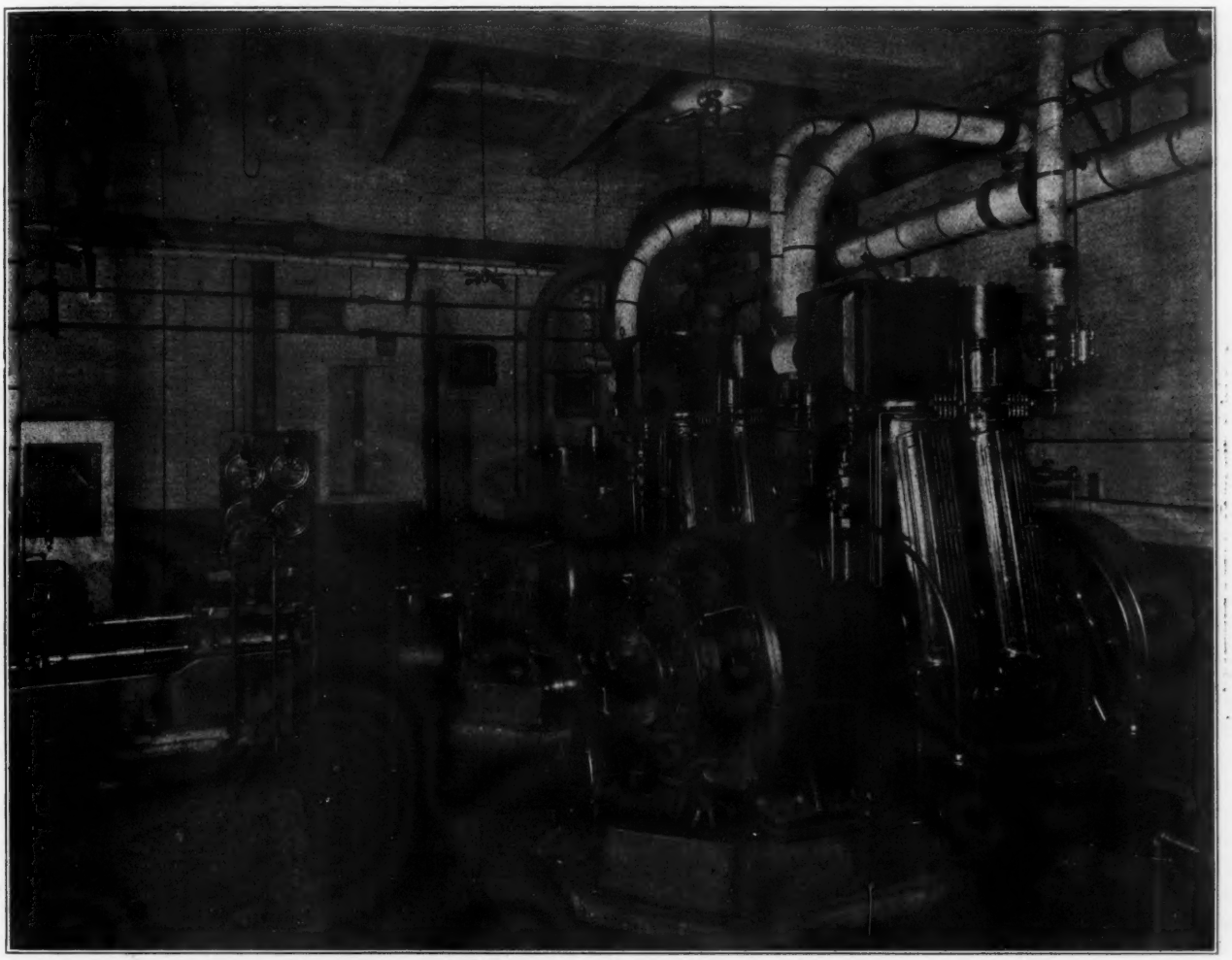
A blow-off connection is provided for each boiler which empties into a cylindrical steel tank placed in a covered pit alongside the boilers. From this blow-off tank the water is syphoned off to the sewer connection. A vapor pipe running from the blow-off tank to the roof carries off all steam.

A five-inch steam main runs across over the boilers near the front of the setting, into the engine room and along the south and west walls of that room.

Each boiler feeds into this main through a five-inch pipe, there being two five-inch globe valves in each steam connection, one at the boiler drum and one at the steam main.

Branch connections from the main are run to each of the three generating sets, to the air-compressor, to the boiler-feed pump, to the vacuum pump of the heating system, to the steam hammer in the forge shop and the high-pressure pump in the flanging shop, and to the heating main. Each of these last two branches are provided with a reducing valve. These valves reduce the steam pressure supplied to the hammer and pump to about forty pounds and that supplied to the heating system to less than one pound.

All of these connections to the main engines are taken from the top of the steam



THE ENGINE ROOM OF THE QUINTARD IRON WORKS COMPANY, NEW YORK CITY.

main through a T-fitting with reducing branch and an elbow. The branches consist of long radius pipe bends there being no joints or fittings between the elbow at the steam main and the throttle-valve of each engine.

All joints in the five-inch steam main are made by flanging the end of the pipe out over the surface of the flange fitting, the faces of these flanges being finished and forming the joint. Copper gaskets were used throughout for all high-pressure joints.

Three drains are provided for the steam main. One from the header over the boilers is carried down the side of the boiler setting and into the ash-pit of the boiler. The steam pump connection is so made as to serve as a drain for one end of the steam main. This connection is carried beyond the throttle-valve of the pump and into a trap which discharges into the blow-off tank. The principal run of the steam main from which the three generating sets, the steam hammer, the heating main, and the vacuum pump receive their supply is drained by means of a one and one-quarter-inch pipe running just below the steam main and connected into the main at two points. From this drain pipe a pipe is carried to a high-pressure trap which discharges into the feed-water heater. In addition a drip is provided for each boiler steam connection.

A bleeder drain is provided for the throttle-valve of each of the main engines. These bleeders are carried to a trap from which this water runs to waste. Cylinder and steam chest drips are also provided for all engine cylinders and steam chests.

The main exhaust pipe runs along the west wall of the engine room just below the steam main from the feed-water heater to the outboard exhaust which runs up through the building and out at the northwest corner. This exhaust main and also the outboard exhaust is an eight-inch pipe with flange fittings. Connection is made from this main to the inlet of the feed-water heater by means of a four-inch pipe and gate-valve. The exhaust connections from each of the three generating sets is made by means of a long radius pipe bend. Angle valves are placed at the exhaust port of each of these engines and these valves are provided with bleeder drains running to a low-pressure trap.

The exhaust from the air-compressor passes across under the floor and up the wall through a gate-valve and into the exhaust main. This gate-valve is provided with a small by-pass drain and a drain is also provided for the exhaust pipe where it rises from the floor. The outboard exhaust is carried down to the level of the bottom of the floor ducts where it is supported upon a concrete foundation capped with a cast-iron plate. Just above the joint between the pipe and this plate a drain pipe is connected. This drain runs across under the floor, unites with the drain from the air-compressor exhaust pipe and from there runs into a low pressure trap.

A Peerless oil and grease extractor is installed in the exhaust main just beyond the point where the last exhaust connection enters. This serves to remove the oil from the exhaust steam which would otherwise escape with the outgoing steam and injure the roof, or would pass into the heating system and from there find its way into the boilers.

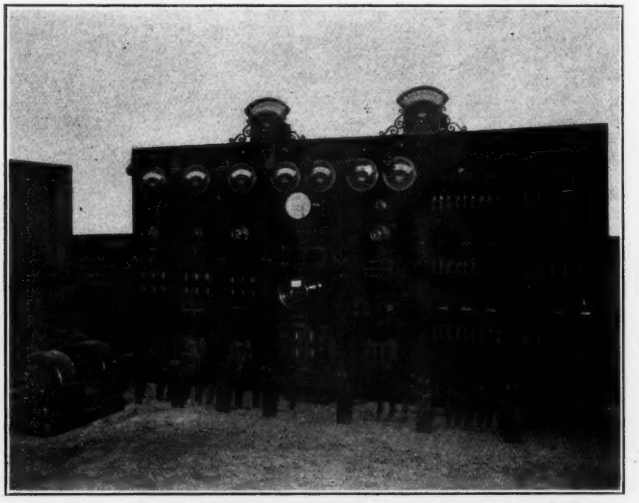
The electrical generating machinery consists of three 240-volt, direct-current, Crocker-Wheeler generators, direct-connected to three vertical cross-compound Watertown high-speed engines. Two of the sets consist of sixty-kilowatt generators driven by 100-horse-power engines and the third of a thirty-kilowatt generator driven by a fifty-horse-power engine.

The cylinder dimensions of these engines are ten-inch and sixteen-inch by ten-inch stroke for the two larger and seven and one-half-inch and thirteen-inch by eight-inch stroke for the smaller.

The lubrication is entirely automatic. Oil is fed to all wearing surfaces from a small tank mounted on the front of the engine between the cylinders. This oil finds its way into the crank chamber and from there it passes through a filter into a collecting and separating tank from which any water which may have become mixed with the oil in its passage through the engine may be drawn off and the oil pumped back into the supply tank. The oil pump is driven from the low pressure valve stem so that its operation is continuous while the engine is running.

Metallic packing is used throughout for the piston rods of these engines. This packing was supplied by the Bridgeport Metallic Packing Company. That used in the two larger engines consists of six cast-iron rings made up in sections and set in a collar in three sets of two rings each. This collar is drawn up on a gasket against the cylinder head. The packing rings are forced against the rod by the pressure of the steam behind them. This form of packing has been found very satisfactory and little or no steam will leak by it. It, however, will not entirely prevent the escape of water and as any

Boiler Plant, Quintard Iron Works Company, New York City.



Switchboard, Quintard Iron Works Company, New York City.

water which may enter or condense in the cylinder immediately runs to the lowest point around the rod, some method of preventing the escape of this water into the crank chamber had to be found. This was accomplished by running a small drain pipe from the collar containing the packing rings. This drain was connected into the drips from the engine cylinders.

There was not sufficient room for a packing of this nature in the small engine and a type known as Law packing was used for the piston rods of this machine. This consists of a series of semi-annular metal rings so constructed that the upper and lower rings are forced against the walls of the stuffing-box and the intermediate rings against the rod when the gland is drawn up.

When this packing was first put in babbitt metal rings were used. It was found, however, that for the rod of the high-pressure piston this metal would melt under the action of the superheated steam and brass rings were therefore substituted. These have worked very satisfactorily.

Electric current from the generators is carried across to the switchboard located in the northeast corner of the engine room by means of wires run in conduit laid under the engine room floor. The switchboard is made up of seven black enameled slate panels mounted upon a substantial angle-iron frame. It was furnished by the A. & J. M. Anderson Manufacturing Company, Boston, Mass.

The three generator panels are each equipped with a double-pole, double-arm. I. T. E. laminated type circuit-breaker, a three-pole switch, the middle pole being for the equalizer connection, a field rheostat and a Weston flush type round pattern ammeter. On one of the generator panels a voltmeter switch is mounted.

Next to the generator panels is a total output panel. This is equipped with two Weston flush type round pattern ammeters, one for light and one for power, a Bristol recording ammeter, a double throw main switch, one side being connected to the bus-bars and the other to the Edison service wires thus providing an emergency connection, a Scheefer recording watt-hour meter, a main power switch, a switch controlling the supply of current to the equalizer panel and a switch controlling the electrically driven boiler feed pump.

The equalizer panel is equipped with an ammeter connected in the neutral wire of the three-wire lighting system and a voltmeter reading from zero in the centre to 125 volts on each end of the scale. Each of these is a Weston flush type round pattern instrument. Directly below these instruments is a two-point voltmeter switch with which the voltmeter may be connected to either side of the lighting circuit.

This panel also has mounted upon it the balancer field rheostat, a double-throw, three-pole lighting switch, one side being connected to the bus-bars and the other to the Edison service wires, a switch for controlling the supply of current to the rotary balancer, a starting box for this machine and a double-pole, double-coil, circuit-breaker. This circuit-breaker is an I. T. E. laminated type provided with both overload and no voltage attachment.

The no voltage coil is connected across one side of the light circuit between the balancer and its controlling apparatus so that this breaker will not remain closed except when the balancer is running.

The blades of the circuit-breaker are connected to the outside wires of the three-wire circuit. One of the overload coils is connected in one of the outside wires and the other in the neutral wire and both act to open the outer legs of the three-wire system. By this arrangement the equipment is protected against overload on the lighting circuits and the balancer is protected against overload from undue unbalance of the lighting circuits without danger of burning out the lamps.

The two remaining panels of the switchboard are the power and lighting feeder switch panels.

Pilot lamps on bracket fixtures are mounted at the top of each panel.

Over the switchboard are mounted a Weston station voltmeter connected to the voltmeter switch on the middle generator panel and a Weston potential indicator connected directly to the bus-bars. Each of these instruments is provided with an illuminated dial.

The balancer which furnishes current for the neutral of the three-wire system consists of two Crocker-Wheeler compound-wound machines mounted upon a common base and direct-coupled. The capacity of this machine is thirty-two amperes of neutral current.

The air-compressor is a horizontal cross-compound steam, two-stage air machine built by the American Air Compressor Works. The steam cylinders are twelve and twenty inches in diameter and the air cylinders eighteen and one-half and twelve. The stroke is sixteen inches and the speed 130 revolutions per minute.

The capacity of the machine is 704 cubic feet of free air per minute delivered at a pressure of 100 pounds per square inch.

A steam jacketed receiver is provided in the connection between the high and low-pressure steam cylinders.

In addition to the water jackets of the air cylinders an intercooler is provided between the cylinders. This consists of a cast-iron cylindrical shell through which the air passes from the low-pressure to the high-pressure cylinder. In this shell is a nest of small tubes secured to headers on each end through which the cooling water circulates. This nest of tubes is so constructed that it may be easily removed. The construction is very similar to that of an ordinary surface steam condenser.

Air is admitted to the compressor by means of a six-inch pipe which runs out into the driveway and up to a sufficient distance to obtain air free from grit. This pipe terminates in a large galvanized iron funnel, the large end of which is covered with a fine mesh wire screen. This serves to keep out papers or any such material which might be floating in the air.

The compressed air is delivered to a receiver in the flanging shop through a three-and-one-half-inch pipe. From the receiver it is piped to various points throughout the works where compressed air is needed.

An automatic governor is provided for the compressor, which controls the speed and also the supply of air, so that the amount of air supplied by the compressor is always equal to the demand up to the limit of the machine's capacity.

A gauge board is provided in the engine room, upon which four twelve-inch gauges are mounted. These are a steam-pressure gauge, an air-pressure gauge, a back-pressure steam gauge connected to the exhaust main, and a gauge for the return of the heating system. The last two are compound gauges showing both pressure and vacuum.

The gauge board is of enameled slate mounted upon an angle iron frame and is illuminated by two lamps in bracket fixtures at the top.

The electrical distribution system throughout the works consists of separate power and lighting feeders which run from the feeder switches on the switchboard to distribution panels located at various points throughout the shop and office buildings. These feeders are all run in rigid iron conduit and each distribution panel is contained in a hardwood cabinet, lined with sheet iron and pro-

vided with slate-lined gutters and a slate-lined door.

A separate line runs directly from the switchboard to the electric crane in the erecting shop and another runs to the motor of the coal conveyer.

From these panels the branch circuits run out to the lamps and motors. Except in the office, where all wiring is concealed in conduit, most of the branch circuit wiring is run exposed on porcelain insulators.

The feeder system for the general distribution of current for both power and lighting purposes in each of the shops was laid out with the idea that this further development could be taken up at any time.

An entirely new heating system has been installed throughout the works, which is operated in conjunction with the new plant. It is a two-pipe Warren Webster vacuum system operating with exhaust steam from the engines on an absolute pressure never exceeding fifteen pounds per square inch, and frequently dropping below atmospheric pressure.

Steam is taken from the outboard exhaust pipe just above where the exhaust main enters it. Just above this connection for the heating system is a back-pressure valve. A live steam connection through a reducing valve is also made to the heating main by means of which live steam may be used to help out the exhaust at times when this is not sufficient. The smaller shops and the office are heated by means of wall coils and radiators. In the larger shops, as, for instance, the boiler shop and erecting shop, overhead coils have been put in, in addition to the wall coils. These overhead coils serve to replace the heat lost by leakage and radiation through the roof and thus prevent a downward cold draft in the centre of the shop, which would be the result of placing all the heating surface upon the walls. Each coil is provided with an inlet hand valve and an automatic thermostatic valve on the return, which is closed by the contact of the hot steam, but opens to the cooler water and air. All of the returns are connected into a single pipe which is brought into the engine room and after passing through a strainer enters the suction inlet of a vacuum pump. This pump discharges into a separating tank, from which the water of condensation drains into the feed-water heater and the air and gases escape through a vapor pipe provided for the purpose.

A connection is made through a thermostatic valve between the feed-water heater and the return main of the heating system, thus preventing the vacuum pump from drawing the steam from the heater.

Although one of the boilers formerly used in the generation of steam required for the operation of the works occupied a portion of the site of the new power plant, the construction and equipment of the plant was carried on without interference with the operation of the old boiler until after the new boilers were ready for use, and during the entire period of construction and of making the change from the old source of power to the new, outside orders were being executed by the company. This was accomplished without serious interruption in the regularity of the company's output.

All of the engineering work in connection with the installation of this complete equipment, including the power plant building, the electrical distribution system and the steam heating system, was done by Putnam A. Bates, consulting electrical engineer, New York city.

Preliminary Outline of the Dedication of the Engineering Societies' Building.

The following programme has been announced in connection with the dedication of the Engineering Societies' Building, 29 West Thirty-ninth street, New York city:

Tuesday, April 16—Formal dedication exercises in the afternoon; general reception in the evening.

Wednesday, April 17—Founders' day; addresses by representatives of the founder societies and institutions, greetings from sister societies and institutions, and presentation of medals in the afternoon. The evening of this day is unassigned.

Thursday, April 18—In the afternoon there will be a session of the American Institute of Mining Engineers. A paper entitled, "Mining Engineering in New York City," describing the excavation and tunnel work now being carried on by the Pennsylvania Railroad, will be presented by H. T. Hildage. In the evening there will be a session of the American Society of Mechanical Engineers, an address being delivered by Brigadier-General William Crozier, entitled, "The Ordnance Department as an Engineering Organization."

Friday, April 19—In the afternoon there will be a session of the American Institute of Mining Engineers, the details of which will be presented later. In the evening there will be an informal smoker for members of all the societies.

The New York Central Accident.

The unfortunate accident in the new electric zone of the New York Central & Hudson River Railroad, in which a train consisting of two electric locomotives and five cars left the track at a curve, with fatal results, has been the topic of more or less free discussion, and resulted in a good deal of unjust criticism. From certain questions asked during the coroner's inquiry, the impression seems to have got abroad that sufficient precautions had not been taken in deciding upon the new equipment. Every one who has followed the progress of this great transformation is familiar with the long experimental tests and the careful investigation of all phases of the problem which were made before the equipment was decided upon, and before that selected was accepted for service.

It will be remembered that the electrical commission which had charge of the transformation was organized in December, 1902; yet the final specifications for the electric locomotives were not approved by the commission until February, 1904. The first locomotive was delivered for initial trial on October 7, 1904, but it was not accepted as the basis for the completion of the entire order of locomotives until May 3, 1905, two and one-half years after the company determined to proceed with the change. This locomotive was subjected to long tests, in which it made about 50,000 miles, under the constant inspection of the vice-president of the road, W. L. Wilgus, who is in charge of the electrification, of the General Electric Company and the American Locomotive Works, which had jointly constructed the locomotive, and of an inspector appointed by the operating department.

After the completion of the first locomotive, the other locomotives, as they were completed, were sent to the New York zone, and there given a second inspection and test under the actual conditions existing in the zone. It may be added that the six-mile experimental track on which the first locomotive was tested was purposely of a much inferior type to that existing in the electric zone, so that any tendency to undue effect by the locomotive upon the track would be accentuated and the necessary modifications demonstrated more quickly than had it been operated on a track of the same quality as that in the electric zone. On certain occasions during these tests the locomotive was driven at a speed of seventy-five miles an hour around a curve elevated but for sixty miles, and during these runs the rails

and ties were shifted bodily in the gravel ballast. This seems to show that the strength of the track was amply sufficient to prevent spreading of the rails, as the curve was distorted without any such action taking place. These prolonged tests, which are certainly more elaborate than any to which a new equipment was ever before subjected, demonstrated to the electrical commission that the locomotive was entirely satisfactory for service in the New York zone.

Since the accident some questions have been raised concerning the behavior of the electric locomotive as compared with the steam. The following information on this point has been obtained from the engineers of the New York Central & Hudson River Railroad:

The company has carried out involved calculations to demonstrate that the conclusions to which practice had led it were correct, to show that the electric locomotive is equal, or superior, to the steam locomotive as regards its effect on curves and the track in general. The locomotive has the same structure and relation of parts as already provided in steam locomotives in successful operation. The comparison was made between the electric locomotive and the Atlantic type of steam locomotive when the two were on a three-degree curve with a four and one-half-inch super-elevation. It shows that the electric locomotive imposes equal or less unbalanced stresses than the steam locomotive, and that the shearing force on spikes, one on the outside of the outer rail in each tie with tie plates, is far within the limits of safety for speeds in excess of the so-called equilibrium speed of about forty-six and one-half miles per hour, to which the super-elevation given corresponds. These calculations show that by assuming the rail to be a beam between two supports that the factor of safety is approximately seven.

Before turning over the new locomotives to the operating department, careful instructions were prepared for those to whom the use of the equipment was to be intrusted, and in these stress was laid upon the necessity for training the men, in teaching them to realize the high speeds attainable with the new locomotive, particularly since the easy running of the locomotive does not give such indications at high speed as are given by steam locomotives.

Another question was that concerning the effect of centre of gravity upon the track. This was involved in the calculations referred to above. However, no allowance is made for the lurch of the steam locomotive, which it is thought throws a much greater strain upon the track than that due to a lower centre of gravity.

These facts indicate that there has been no lack of caution in carrying out this work; that all sources of danger were duly considered, and no effort spared to produce a locomotive which would be as nearly perfect as possible. Even though the necessity existed for hastening the change of system, so as to minimize the dangers of operation in the Park avenue tunnel, due deliberation was observed in carrying out all parts of the work.

The cause of the accident is as yet unexplained. It is known that the train was traveling at a high speed, but the track has been shown capable of withstanding the unusual strain without damage. It seems probable that some unknown accident, combined with the high speed, caused the wreck.

Big Telephone Project.

Prominent Detroit men are named among the incorporators of the new Interstate Long Distance Telephone Company, which has filed papers of incorporation for $15,000,000 at Lansing, Mich. They propose to connect the independent telephone systems of Michigan, Ohio and points east and south, and to build a long-distance system throughout Michigan, with new pole lines to Toledo, Adrian, Jackson, Lansing and Holly. This will give them a direct line to Chicago and connect with practically all the outside systems. Work will be pushed at once, the sum of $1,500,000 being set aside for construction work this year. The incorporators include William R. Woodbury, president of the Home Telephone Company; Henry C. Potter, Jr.; John M. Dwyer, Fred. T. Moran, George E. Lawson, Hugo A. Koehler, Max Koehler, C. Marquard Forstar, T. H. Wagoner, Charles H. Hood, Sam B. Jeffries, W. T. Barbour, Henry Koehler, Jr.; W. W. Grayson and J. J. Goodyear. They will also form a part of the executive board which will control the Home company, as well as the new concern. A voting trust has been formed which makes a sell-out to any competing line impossible. The capital stock is to be issued in $100 shares, of which $150,000 is the initial issue and a third of this amount is already paid in. Two-thirds of the entire stock will be preferred. Capitalists interested in the Home company have secured large holdings in the Dean Electric Company, of Elyria, Ohio.

THE QUARTER-CENTURY NUMBER.

The ELECTRICAL REVIEW has received a number of letters from all parts of the country, testifying to the appreciation of its readers of the Quarter Century Number published last week. We take pleasure in publishing below two of these testimonials which are typical of the many expressions of commendation thus elicited:

TO THE EDITOR OF THE ELECTRICAL REVIEW:

With pleasure do we extend our congratulations on the anniversary of your twenty-fifth year of existence and our compliments on the up-to-date and tasteful appearance of your twenty-fifth anniversary number of the ELECTRICAL REVIEW, a number worthy of preservation and remarkable for the interesting articles by writers of such prominence and greatness in their respective fields.

"Many Happy Returns"—a wish accorded with real pleasure to a journal of such high character, sterling worth, and reliability as the ELECTRICAL REVIEW.

THE PHOENIX GLASS COMPANY,
A. H. PATTERSON, Vice-President.
NEW YORK, March 11.

TO THE EDITOR OF THE ELECTRICAL REVIEW:

We desire to congratulate you on your most excellent issue of March 9. We think it is the finest issue of an electrical paper we have ever seen; not only as to reading and news pages, but advertising pages as well.

THE BANNER ELECTRIC COMPANY,
N. L. NORRIS,
Secretary and General Manager.
YOUNGSTOWN, OHIO, March 11.

The Iowa Independent Telephone Association.

The eleventh annual meeting of the Iowa Independent Telephone Association will be held at the Garretson Hotel, Sioux City, Iowa, March 19, 20 and 21. One afternoon is to be devoted exclusively to the rural companies, and a large number of rural telephone men are scheduled to deliver brief addresses on different phases of the subject. The programme will have features of interest to investors, managers, and both the large and small operators. The railroads have made a rate of one and one-fifth fare for the round trip, on the certificate plan.

The National Electric Light Association Convention.

The annual convention of the National Electric Light Association will be held at the New Willard Hotel, Washington, D. C., on June 4, 5, 6 and 7. There will also be the usual exhibition of electrical devices.

REVIEWS OF CURRENT ENGINEERING AND SCIENTIFIC LITERATURE

An Electrically Driven Cotton Mill.

A description is given here of the electrical equipment of the Droylsden mills, Fairfield, England, the method of driving of which has just been changed from steam to electricity. A condition making the transmission somewhat difficult was the necessity of keeping the mill in operation during the change. The mill contains 88,900 spindles and 900 looms. These are now driven by twenty-four motors with an aggregate rating of over 1,000 horsepower. The whole mill is also lighted electrically. Power is derived from a generating plant, the engine room of which was formerly occupied by an old beam engine, first installed to drive the mill, and later converted to a pumping engine. The present generating equipment is a steam turbo-generator rated at 1,000 kilowatts. The contrast between the new machine and the old is striking. The old engine weighed about 100 tons, and ran at twenty-three revolutions per minute. The new weighs twenty tons and runs at 1,500 revolutions. The latter requires an engine of only 2,400 cubic feet, the other calling for 38,500 cubic feet. All the motors driving machinery are of the three-phase induction type with enclosed slip rings and metallic gauze covers on the end plates. In some instances the motors are hung from the ceilings; in others they are placed on brackets attached to the posts supporting the floor above. In some, the motors were built into recesses cut in the walls. As a rule each motor drives machinery on its own floor, but in other cases it has been placed so that it can drive machinery on two or more floors.—*Abstracted from Electrical Engineering* (*London*), *February* 21.

New Use of the Braun Tube for Studying Magnetic and Dielectric Hysteresis.

A method of using the Braun cathode-ray tube for tracing hysteresis curves was suggested by Ångström, which consists in placing the tube between two pairs of coils placed at right angles. One pair contains the iron under investigation, and the other pair contains no iron, and therefore merely sets up a field proportional to the current in the line. The result of the two magnetic forces thus set up—one being proportional to the current and the other to the intensity of magnetization—is to deflect the ray from the tube so that it traces on the fluorescent screen the I-H curve of the iron. In this arrangement the effect of the exciting coil around the iron is eliminated by means of a second coil. E. Madelung here describes another method of using the Braun tube for studying either hysteresis of iron or dielectrics. The first arrangement consists in connecting in series with the magnetization coil a second coil, and placing around these two coils secondary coils which are connected to two pairs of plates placed at right angles around the tube. With this arrangement the two pairs of plates will be charged to potentials at each instant proportional to the rate of change of the magnetic field of each coil, and a curve will therefore be obtained showing the rate at which the change in magnetization changes with the change in current. This arrangement is objectionable, since no correction has been made for the field of force due to the magnetizing coil. This is accomplished by placing a third coil in series with the other two and surrounding it by a secondary which is connected in opposition to the secondary around the magnetizing coil. Or the same result may be accomplished by connecting the secondary of the magnetizing coil in series in the opposite relation to the secondary of the current coil. In other words, the latter coil may be used both for giving a deflection proportional to the rate of change of current and for eliminating this force from the magnetizing coil itself. To study dielectric hysteresis, two condensers are taken, connected in series, the dielectric removed from one and connections made from the opposite sides of the two condensers to the two pairs of deflecting plates. The curve obtained by this arrangement is that showing the relation between the electromotive forces across the two condensers. A curve showing the current relations may be obtained by connecting the two condensers in parallel, the dielectric plate being removed from one, and connecting in series with each one a deflecting coil, the two coils being placed at right angles, so as to act upon the Braun tube. By placing large non-inductive resistances instead of the two deflecting coils, the deflecting plates may take the place of the latter. The author has tested these arrangements, and has found that they give good results. Two curves are shown, one giving the relation between the change of magnetization and change of magnetizing force; the other the change in condenser charge with change of current. In both cases the hysteresis effect is brought out clearly.—*Translated and abstracted from the Physikalische Zeitschrift* (*Leipsic*), *February* 1.

Wireless Telephony.

A review is given here by R. A. Fessenden of his endeavors to perfect a system of wireless telephony. It is pointed out first that, broadly speaking, wireless telephony must be accomplished by generating a practically continuous source of electromagnetic waves, by modifying the character of emitted waves by means of sound waves without interrupting their continuity, and by receiving them on constantly operative receivers. At the time the author took up the work there were three methods of setting up electromagnetic waves—the plain aerial with spark gap, used by Marconi; the plain aerial, heavily loaded with inductance, used by Lodge, and the plain aerial in conjunction with a local oscillatory circuit having a period of a different order of magnitude from the period of the antenna, used by Braun. He devised a new method, consisting in using an antenna in conjunction with a local circuit tuned to the same frequency as the aerial. With this system, and by means of an induction coil and a commutator giving 10,000 sparks per second, articulate speech was transmitted in 1900 over a distance of one mile. The articulation, however, was not good, and there was an extremely disagreeable and, at times, overpowering noise in the receiver, due to the irregularity of the spark. With sparks in air the best results were obtained by using a slightly convex disc of platinum-iridium for one discharge terminal, and a pointed aluminum cone for the other. It was found that if the spark was caused to take place in compressed gas much better results were obtained. The gas was nitrogen, which was obtained by pumping the vessel up with

compressed air and placing lime in the bottom of the chamber to absorb the nitrous acid formed by the discharge. A mercury gap of the Cooper Hewitt type was used, but did not give results as good as those given by the compressed-gas gap. Another method giving fairly good results was the use of a 10,000-cycle, one-kilowatt alternator. This gave about 20,000 sparks per second, and by means of it speech was transmitted more distinctly; and on account of the regularity of its action, the results given were quite as good as those obtained with the compressed nitrogen discharge gap. These methods of setting up electrical waves, while sufficiently continuous for the purpose of telephoning were not completely continuous. It was found that fairly good articulation could be obtained with 10,000 sparks per second. A great many methods for obtaining continuous waves were devised and tested, but few of them gave satisfactory results. Thomson's musical arc was not entirely satisfactory, though it was improved considerably by the use of cooled electrodes, an air-blast and magnetic blowout. It was found, however, that neither frequency nor intensity was constant, and that the key could not be used to make and break the circuit, since the arc would not start itself. The system was modified by adding a resistance to the arc circuit. This enabled the frequency to be maintained nearly constant. Another method tried was an aluminum disc revolved under a brush, but this gave rise to objectionable scratching and hissing in the receiver. The best results have been obtained by means of an alternator designed for a frequency of 100,000 cycles and an output of one kilowatt. In practice, however, this machine has never driven above a speed which gives 80,000 cycles. For most work it is run at 60,000 cycles. The alternator is generally connected to the aerial through a transformer, the connection being tight as the energy falls off, when a loose couple is used. At the receiving end the usual liquid barretter receiving system was used, the strength of the received speech being twenty-five times that of audibility, as speech could be understood when the telephone, whose resistance was 1,200 ohms, was shunted by a forty-ohm resistance.—*Abstracted from the Electrical Review (London), February 22.*

The Berlin 24,000-Line Telephone Exchange.

Exchange No. 6 of the Berlin (Germany) telephone system has recently been opened. This is the largest telephone exchange in Europe, and is designed to accommodate 24,000 subscribers' lines and 2,100 trunk lines. A brief description is given here by Alfred Gradenwitz. At the present time 18,000 subscribers' lines and 1,200 trunk lines are in service. The new exchange is situated in the western part of Berlin, in a special building. The switchboards are installed in two large halls on the top floor, placed side by side, and connected together by corridors. Just below the operating floor is a room twelve feet high, in which the distributing frame, the relays and other auxiliary mechanisms are placed. A special part of this room is shut off for the storage battery. The same room contains the ringing generator unit and the two charging motor-generator sets. The switchboards are of the horizontal type, used because they are said to possess the advantages of small space requirements. The arrangement of connections is such that only two external circuits are used inside of the system—that is, a two-wire multiple is used. The two operating halls are about fifty feet in length, and at the present moment contain forty-two panels of switchboard, each with six operating seats. The operators sit three on each side of a section. The calls at this exchange are handled in the following way: the subscriber calling removes his receiver and thus automatically lights a lamp at the exchange. The operator there answers by inserting an answering jack situated immediately behind the lighted lamp, at the same time throwing the corresponding listening key. This automatically cuts out the line lamp. After ascertaining the desired connection the operator inserts the calling plug in the multiple switch jack of the desired subscriber and calls him by throwing the key into the ringing position. From this position the key, of its own accord, returns to its normal position, thus making the desired connection. When the receivers are replaced upon the hooks supervisory signals are automatically lighted, indicating to the operator that the connections may be taken down.—*Abstracted from the American Telephone Journal (New York), March 2.*

The Utilization of Tides.

The use of tides as sources of hydroelectric power is considered here by Henri Presson. The method contemplated consists in creating two reservoirs or basins which communicate with the sea by means of control valves. One of these basins is filled at high tide, and the other emptied at low tide. The water is allowed to flow from one to the other, driving turbines connected to generators. A study of the tides has shown that in this way continuous power can be depended upon for about ten hours. Two hours must be allowed for filling and emptying the basins. For this reason the author thinks that tides should be considered as periodic sources of power, rather than irregular. To carry out the arrangement it will be necessary to have attendants at hand for operating the valves, but they could be dispensed with if the valves were operated by motors controlled from the power-house, or if automatic valves were installed which would open and close when the water pressure due to the tide reaches certain predetermined values. Three important installations of this kind are now being considered in England. One of these is at Chichester, where the estuary may be easily divided into two basins approximately equal in area. It is estimated that under ordinary tides about 6,800 horse-power may be obtained, and under unusually high tides, 13,800 horse-power, for ten hours a day. At Menai Strait a dividing dam would make available a considerable hydraulic power, because of the difference in the time for tides at the two ends of the strait. The difference in height at times is as much as twenty-two feet, and the average is about sixteen feet at high tide. At Bristol it is contemplated creating two reservoirs, which will make available a maximum fall of thirty feet and a minimum of seventeen feet. There would be an average fall of nearly twenty feet for twenty-eight hours, and the power available for average tides would be about 240,000 horse-power. For exceptionally high tides it would be over 500,000 horse-power. The author then points out that the coast of France offers a number of sites where this method could be utilized with advantage. This would be particularly true of the coasts of Brittany and Normandy, where the difference in the tides is about forty feet.—*Translated and abstracted from L'Électricien (Paris), February 16.*

A Correction.

On page 195 of the issue of the ELECTRICAL REVIEW for February 2 an abstract of an article by H. F. Parshall, entitled, "General Principles Appertaining to the Supply of Electricity for Industrial Purposes," was credited to the *Electrical Engineer*, of London. This should have been credited to *Electrical Engineering*, London.

Methods of Getting New Business

A DEPARTMENT DEVOTED to the COMMERCIAL DEVELOPMENT of CENTRAL STATIONS

Managers are Invited to Contribute Suggestions for Methods of Increasing the Demand for Electric Service

EDITED BY CHARLES A. PARKER.

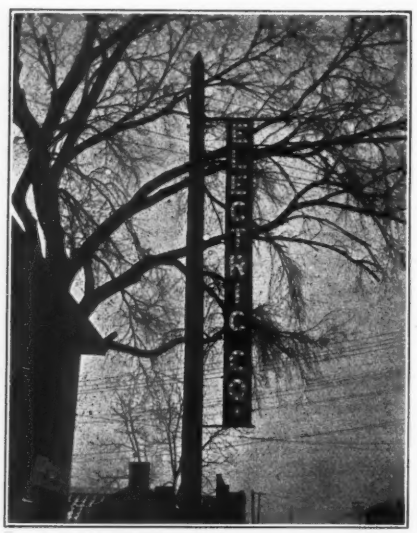
The Public Is from Missouri.

You won't need to drag the earth with a fine-tooth comb to discover plenty of people who have made a short trip to Missouri, and returned with the popular Missourian trait implanted in their bosoms.

You've got to "show 'em." You've got to show them by practical demonstration.

Your printed advertising exerts a wondrous power in the way of putting your people in the right frame of reasoning. Folks may drink in all you claim like one athirst after a long-sought truth, but after all is said and done, your people, as a final test, will demand to be shown. They not only want to learn about your proposition, but want to see, with their own eyes, the thing itself.

No mortal man can look upon the actual working thing, and then deny it. His technical knowledge of electricity may be a little wobbly; he may have no more idea of watts and ohms than he has of an unclean limb of Satan—yet he has eyes in



The electric sign in front of the Marion Railway Light and Power Company's office, Marion, Ohio. This company believes in setting the example to prospective users of electric signs.

his head, and when he witnesses a demonstration of the various uses of electricity, he can not doubt his own senses.

Actual demonstration admits of no brash claims, and besides, it banishes all doubts. It is the checking up, the rounding out, the final, irresistible proof. People don't have to take anybody's say-so for anything. The thing is there, ready to perform, thus showing its precise worth.

In its right place, demonstration is the thing. It is not in its right place when it essays to do all the work alone, even to the exclusion of printed advertising. When wedged in amidst your regular advertising, however, it forms the rock on which the public's indifference, suspicion or prejudice splits.

Take for instance, the usual central station display room. Is it made attractive? Are the various electrical devices shown therein, properly exhibited? Are these devices connected up and actually operating? Is there some one person in the office deputized to explain these devices to callers who evince an interest in them? Is it this person's duty to demonstrate these devices in a practical way, so that the public can see exactly how they do their work in home, store or factory?

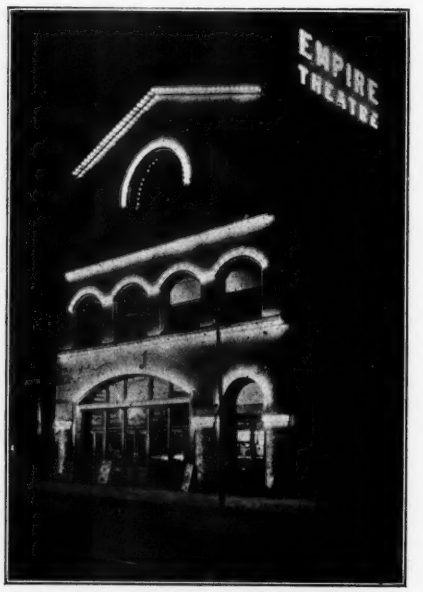
The central station may flatter itself that it has provided all these things. It may feel perfectly satisfied that it has done its duty, and that there is nothing further to worry about. Maybe there isn't; likely there is. The storekeeper or shop owner who ought to see these demonstrations of electrical illumination, and fans, and power, etc., seldom has an opportunity of doing so because he seldom visits the office of the central station company. When his monthly electric bills fall due, he sends a check, or his office boy, to pay them. Consequently, so far as his knowledge goes, there is no such a thing as a display room in existence—and so another chance for further business goes glimmering.

As regards residence patronage, does the busy housewife often call at the central office to pay the monthly bill? Sometimes; not often. She is engrossed too much in her domestic duties to go herself to the central station office; and besides, she doesn't consider the paying of electric bills a woman's work. So she sends Bridget, or one of the children, or depends upon her husband to mail a check.

Under such circumstances as these, while your display room may be perfect in purpose, it gets no chance to impress itself on the very persons at which it is expressly aimed.

There is no use denying that there are a number of men and women who do visit the office, and thus see the display and demonstration room. To these people it appeals, of course. But what about the rest of the people? Can't something be done to interest them? It would seem so.

Supposing the central station should set certain hours of certain days, every month,



Theatres, as a usual thing, are lavish users of electricity. Are you doing your duty in showing them what can be accomplished by an effective outline and an electric sign?

to throw open the doors of the powerhouse to the public. Most everybody is curious to know and to see how electricity is manufactured. It is a mystery to most people, and anything that partakes of the mysterious naturally invites investigation. If the central station could arrange to invite the public to come and see the inner workings of its plant, and perchance to be guided through the plant by an employé whose duty it is to explain the various working of current making, the probability is that the public would gladly grasp the opportunity, and soon become interested in electricity as never before. Those who come would tell their neighbors and friends, and soon others would become interested and call, and they in turn would become enthusiastic, until

after a while, "central station day" would establish itself permanently. Thus your display room and demonstrations would insinuate themselves on the public mind, and impress it.

The value of such personal advertising as this can hardly be over-estimated. It would form the most forceful aid to your regular printed advertising. It would direct special attention to it. It would go far towards discouraging its being thrown away, unread, by the recipient. When you can, by display, demonstration and mail advertising, keep yourself in the public's mind, your problem is approaching solution surely, quickly, profitably and pleasantly.

As about every move the central station makes may be considered advertising, in one way or another, it is not a bad plan to have on display pictures of the central company's offices, power plant, and such interesting electrical devices as it is trying to exploit. Human nature has not outgrown its inherent weakness for big things, and there is hardly anything that throws out a sense of importance, honesty, and substantiality more than pictures, showing the bigness and completeness of the central company's buildings.

The central company need not take all the responsibility on its own shoulders, either. There are the department stores, furniture stores, etc., which offer splendid possibilities for the demonstration of small power motors. Electric fans, flatirons, curling tongs, hot water bags, cooking devices and sewing machines also may be shown, connected up with a demonstrator in charge to operate them, as well as to offer suggestions and answer questions. This is one of the most direct and impressive methods of reaching and persuading the women-folk. A woman sewing at an electrically driven sewing machine is peculiarly attractive and suggestive.

And too, it must not be forgotten that central station officials can exert a telling example by employing modern electrical devices in their homes. They are the ones who, above all others, ought to realize and take advantage of the good things electricity offers. If they have no faith in their product, how can they expect others to have? The example they set, sooner or later, gets noised about town, and furnishes additional evidence that electricity is the thing for every home.

Why shouldn't the central company employ fans in its office, during the heated term of summer? Why shouldn't the central company put up electric signs on its premises to advertise itself? Why shouldn't the central company put into commission a heating apparatus in one corner of its office, so that visitors may see and feel what it is actually capable of doing?

There is no doubting actual demonstration. It furnishes the proof, the final argument, the capping climax. "Show me," is the spirit of the times. And in no other line of commercial human endeavor is there a better opportunity to satisfy the man from Missouri.

Under this general heading we shall present to our readers a series of bright, stimulating talks to solicitors, which, we believe, will prove valuable to managers of new-business departments in suggesting points which they can profitably bring out in their occasional meetings with the company's representatives.

We shall gratefully accept contributions and suggestions from any of our readers.

Now, be careful with your answers, fellows.

This morning I'm going to ask each of you what you consider, in a word, the best method of getting hard-shell prospects interested in using our current.

Remember, these little informal talks among ourselves benefit the whole force, so don't be backward with suggestions.

Well, Jones?

"Sticktoitiveness" you say. All right, we'll chalk that down.

And you, Brown?

"Complete knowledge of your subject." We'll put that down too.

And what do you say, Smith?

"Enthusiasm." That is necessary, all right.

And Nelson, yours?

"Confidence and faith in yourself and proposition."

All good, boys. Rightly used, your methods wil get the business a good many times. But, to my mind, you've overlooked one of the most important points of all.

What is that?

I'll tell you in one word. It's the man himself.

What do I mean? Simply this. The average man doesn't care anything about you and your company—or anybody else's. He's all wrapped up in his own business—his own doings—his activities—his achievements—his family—his friends—his ambitions—needs and desires. Touch him on any of these points right at the start, and you ring the bell of his immediate attention.

For, unless you approach your man right, the chances are not very bright for landing him. So begin talking about him and his company—not about yourself and your company. Touch him on some vital need in his business—some defect or tangle—some weak spot he wants to remedy—some cherished ambition that haunts him. Ask him to show you through his plant. Compliment him on his enterprise and progressiveness. Suggest where still further improvement could be made with current. For, until he can see some connection between it and his welfare, he won't have the slightest interest in your proposition. Remember it's his business—not yours—he's interested in. That's where he lives day and night, and a knock at the door will always find him home.

Hope you catch the drift of all this, boys.

Gain a man's confidence by showing him you have an interest in his personal welfare. Show him that he needs you just as much as you need him—and the rest should be easy. For in all the busy whirl and swirl of a man's business there is only one topic of never-failing interest to that man. That topic is—"himself."

Under this heading we shall, from week to week, present to our readers a little series of inspirational aphorisms (original, aboriginal and selected), which will, we believe, prove stimulating and suggestive to those who are interested directly or indirectly in the sale of central station current.

Be a master joiner—fit your talk expertly to the proposition—not with glue, but screws.

To succeed, get a hold—and hang on—inertia is often as good as enterprise.

A poor solicitor is like a friend in need—he's a source of expense.

After all, its the solicitor himself who has to be the captain—the manager is only a pilot.

The electrical world's a stage, and all the solicitors actors—but it is those who don't work that sit in the gallery and throw things.

Solicitors who do things, and not the

solicitors who merely talk about things, are those who bless the stockholders.

The solicitor who is nothing but a suit of clothes and a carnation may do business with fools, but never with wise men.

The really big guns never get loaded—maybe that's why they are big guns.

Promises may get contracts, but 'tis performances that keep them.

He that sets his net betimes may expect a fuller draft than he that fishes later.

Prospective customers have about as much interest in a proposition that does not ring true as a girl has for a man who hasn't an engagement ring to him.

To make a sale and make an enemy in the transaction is poor business policy.

You can't skin the public until they are overcome with admiration.

Pull out the throttle, throw on the coal, oil up the cylinders, shoot down the tracks and you'll come in collision with more business.

Make electricity the "reason why" stuff—it sells easiest.

Making a good showing is all right—but "making good" at the finish is better.

It will be our endeavor, from week to week, to present in this department brief notices of activities among the central stations, as gathered from men who are in the field and, consequently, in close touch with the progress of the new-business idea and its acceptance by central station managers. Contributions to this department are solicited, and will be received with much appreciation by the editor.

If you are doing something a little better than or different from the other fellows, and think it would make interesting reading to ELECTRICAL REVIEW readers, send in your schemes and plans. They will be gladly received.

Address all communications to Charles A. Parker, care of the ELECTRICAL REVIEW.

"Ye that have tears prepare to shed them now," is what one of Shakespeare's characters is purported to have said upon a certain sad occasion, and certainly the chapter of accidents which has happened to mar the peaceful progress of the Marion Light and Power Company, of Marion, Ohio, is sufficient to recall the quotation.

Last August a bad boiler explosion occurred which, at one fell swoop, deprived this aggressive company of the wherewithal to give good service or good regulation, even to their present consumers,

Mr. Frank Glosser, superintendent of the Lighting Department of the Marion Railway, Light and Power Company, Marion, Ohio, who is conducting a class in electricity at the Young Men's Christian Association in that city.

leaving them but little temptation to follow the path of the hustler and get out after new business. In the emergency, a dummy substation was rigged up in a box-car to help out, and since that time the company ran until January 1 with no ammeters in circuit and only one voltmeter. Current was brought in at 2,200 volts on three No. 2 wires, which occasioned so great a drop that it was necessary to install ten-kilowatt line transformers in each phase for boosters. In three days' time the entire up-town distribution was changed from 1,100 to 2,200 volts, and the company had to install step-down transformers for the outlying districts, using line transformers, stepping down from 2,200 to 220 and then stepping up from 220 to 1,100. The 200-kilowatt frequency-changer installed in the aforementioned box-car supplied the entire load through the holiday season and must have been greatly overloaded, although no test was made at that time; but even since January 1 the load has been as high as 290 kilowatts.

From this it will be seen that the company has been laboring under a terrible disadvantage and actual new-business aggressiveness has been practically out of the question. In spite of this, however, the company has continued to issue exceedingly attractive and effective advertising through the mails, and it is a source of great gratification to know that, despite the conditions, the company's business has increased appreciably. The very greatest credit is due to the management in that it has used every resort to take care of present customers in this emergency. Mr. Glosser, who is in charge of the new-business department, has been for over three years with this company and was formerly superintendent of the electrical department of the Evansville Gas and Electric Company. As an illustration, he cites an instance of the company's care of customers in the following:

Photograph of the class in electricity conducted by Mr. Glosser at the Marion, Ohio, Young Men's Christian Association. Here is a distinctly new and efficient method of spreading the gospel of the uses and advantages to which electric current can be put.

The Marion *Daily Star* bought a new press and three-phase motor at the same time, depending, of course, on the lighting company to furnish power for the motor. When ready to operate it was found it

could not get three-phase power on account of the explosion and the company, in order to tide over the difficulty, borrowed a twenty-five-horse-power, 500-volt motor from the General Electric Company, paying $26 freight charges from Lynn, Mass., $10 on top of that for installation and $26 more for the return of the motor as soon as the three-phase service was ready.

This is one of the most striking examples of thorough earnestness in a desire to take care of present business, and the Marion Electric Light and Power Company is deserving of all credit for this

Get That "AFTER DARK" MONEY
HAVE your show windows properly illuminated. Many a sale is started "the night before."
Many people decide where they will buy as they wander through the brightest streets in the evening. And if your windows are properly lighted, and the light is selling your goods, it is at least only good business to burn your name and sign into the minds of the passers-by.
Kansas City Electric Light Co.
Kansas City, Mo.
Many a sale is made after your store is closed if you light-up and display the goods

This mailing card, sent out by the Kansas City Electric Company, is what can be called good, strong advertising—attractive, suggestive and well written.

and many other problems which it met and faced successfully in this emergency.

Considerable success has attended the introduction of the new Gem, high-efficiency lamps in this city. Over 300 of the 125-watt and 200 of the fifty-watt, 100 to 250-watt are on circuit. Free renewals of these lamps are furnished.

A new departure in the lines of what might be called indirect advertising is in connection with Young Men's Christian Association work in Marion. We believe this is one of the most novel and unique steps which has been taken by any lighting company in popularizing electricity and its own service, and especially desire to commend this line of action to all central station managers situated in cities where the Young Men's Christian Association has a local branch.

As worked out in Marion, the situation is this: Mr. Glosser instructs a semi-weekly class in the evenings at the Young Men's Christian Association on electricity. The class is composed of young fellows, some attending high school, students, etc. The company furnishes all the material which is used in connection with the lectures and also furnishes free all current used for the same purpose. The photograph shown herewith will give a good idea of what is being done along this line, and the picture shows a complete lighting plant which has been set up by the students themselves from material furnished by the company. This plant has been taken apart and put together again by almost every individual member of the class.

While, of course, this work is not purely a matter of the lighting company's advertising, it being a part of the Young Men's Christian Association work, it is especially effective in increasing the interest of the young men in the city in the subject of electricity, and must make all those attending the classes exceedingly anxious to see things go ahead electrically in their city. As a matter of fact, several of the young fellows who are attending these classes are likely to become solicitors for the company, and naturally their training along technical lines will be most useful to them in a great many ways when they come to take up soliciting work.

New York Electrical Society.

The New York Electrical Society held its 265th meeting in the Engineering Societies Building February 27. Professor Harold B. Smith, in his address on "Power Transmission Voltages of To-day and To-morrow," outlined briefly the history of electric-power transmission at high potentials, beginning with the pioneer plants of 1890 to 1895, and tracing the progress of experimental and research work, together with actual installations, from that time to the present. The subject of power-transmission voltages of today and to-morrow led to some estimate of probabilities in the matter of developments within the next few years. It was shown that of the three factors entering into power transmission on a commercial basis, the line, the insulation and the transformer, less difficulty was to be expected in reaching higher voltages from the transformer than may be encountered with either the insulation or the line construction. In all three of these features there is much room for improvement, and there seems to be a reasonable prospect of the solution of many of the problems involved in the near future, permitting transmission at higher voltages than any yet attempted on a commercial scale, and over much greater areas than are now considered feasible. The use of voltages of 120,000 to 150,000 is, in fact, a not distant possibility.

In a series of lantern slides the development of experimental transformers built at the Worcester Polytechnic Institute for voltages up to 50,000 was shown and numerous illustrations were given of notable recent installations.

The following members were elected: W. G. Heep, E. Hugh Watlington, F. H. Ballon, F. M. Swaney, Frederick J. Good, Arthur Eichenberg, M. L. Pomares, Robert Velton, Archie Wainman, Frank Sutton, R. W. Marshall, L. G. Nilson, Charles H. Bedell, Francis X. Scott, Walter A. Seymour, Raymond Cilley, William Simpson, Harold P. Daniels and Sheldon Leavitt, Jr.

The Technical Publicity Association.

On the evening of February 28 a meeting of the Technical Publicity Association was held at the rooms of the Aldine Association, New York city. This was designated as "Railroad Night." New members were elected representing Harrison Brothers & Company, Philadelphia, Pa.; the Joseph Dixon Crucible Company, Jersey City, N. J.; the Lunkenheimer Company, Cincinnati, Ohio; Manning, Maxwell & Moore, Traylor Engineering Company and Triumph Electric Company, New York city.

G. M. Basford, assistant to the president of the American Locomotive Company, a member of the association, presented a paper entitled, "Progress in Transportation." W. H. Boardman, editor of the *Railroad Gazette;* J. B. Meek, manager of the railroad department of the H. W. Johns-Manville Company, and R. V. Wright, editor of the *American Engineer and Railroad Journal,* were guests.

George A. Cullen, general passenger agent of the Lackawanna Railroad, gave an informal address.

The following companies were represented by members at the dinner: A. Allan & Son, T. R. Almond Manufacturing Company, American Locomotive Company, American Wood Working Machinery Company, A. S. Cameron Steam Pump Works, Crocker-Wheeler Company, General Electric Company, Hammacher, Schlemmer & Company, Ingersoll-Rand Company, H. W. Johns-Manville Company, Lidgerwood Manufacturing Company, New York Edison Company, New York Telephone Company, Niles-Bement-Pond Company, Sprague Electric Company and Yale & Towne Manufacturing Company.

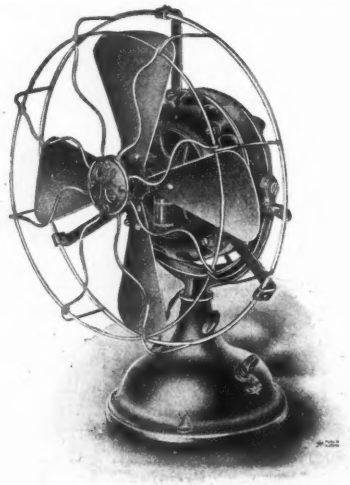
INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

General Electric Fan Motors for 1907.

Fan motors have reached a place where they are perennially useful. Not only are they now available for cooling purposes in summer, but they may be used to augment the heating during the colder months, as well as to supply air in motion for dozens of other interesting purposes. When the central station man sells a fan motor, today, it becomes, with a few judicious hints, not the least valuable of revenue-getters.

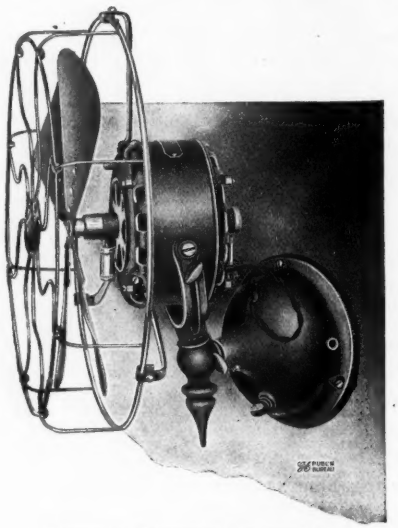
The General Electric Company, Schenectady, N. Y., makes a complete line of fan motors which can be advantageously introduced as business-getters during both summer and winter. Desk fans as usual



GENERAL ELECTRIC DESK FAN.

are furnished in all different types for standard voltages and frequencies or can be wound special to order. Both direct and alternating-current fans of the desk type can be obtained with twelve-inch or sixteen-inch blades. These with the bracket type fans of the same design and sizes are available for all classes of service. In addition to the ordinary uses for cooling, office desk or domestic ventilation during the summer months, they will keep the frost from the storekeeper's window or supply air currents for advertising novelties of various kinds.

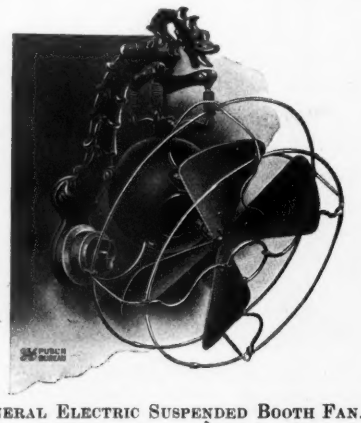
In a store on a windy street an odd use of a fan of the desk type was recently noticed. The customer's entrance to the shop was accompanied by a stiff breeze which badly disarranged the near-by counters. A large fan motor was mounted opposite the door so that the force of the air counteracted the entering breeze, the



GENERAL ELECTRIC BRACKET FAN.

door by this method being opened in comparative calm.

Combining the compact and efficient general design of the desk and wall bracket types of fan motors, with special mountings are the telephone booth ventilating fans and the exhaust fans. The spring suspension of the former eliminates

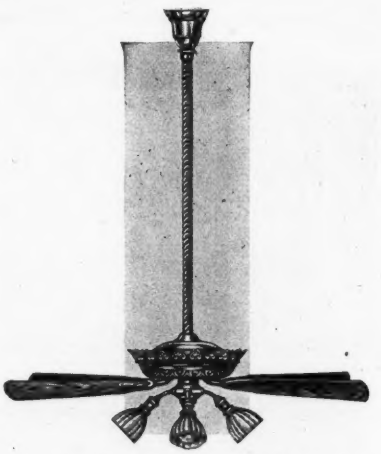


GENERAL ELECTRIC SUSPENDED BOOTH FAN.

vibration in the telephone booth and makes what is ordinarily a Turkish-bath cabinet more bearable in summer. The General Electric Company can furnish eight-inch telephone-booth fans for both alternating and direct current at commercial voltages and frequencies. The exhaust type of fan is useful in both private and public kitchens, in restaurants, lavoratories and stores where a permanent method of ventilation is desirable.

Quite recently the use of the fan motor in the cold-air pipe of the hot-air furnace has been exploited, as an economical addition to this heating system. The square frames of the exhaust fan types might readily be adopted for this purpose and a permanent installation be made.

The broad wooden blades of the ceiling type of fan suit them especially for the cooling of large areas without disagreeable drafts. The fan blades are fifty-two inches in diameter for alternating-current fans and fifty-six and fifty-eight inches in diameter for the direct-



GENERAL ELECTRIC CEILING FAN WITH ELECTROLIER.

current motors. All have four blades and can be obtained in plain or in ornamental designs. The alternating-current ceiling fans have two or three speeds, while the fifty-eight-inch blade, direct-current fan can be operated at three speeds and the fifty-six-inch blade, direct-current fan, at a single speed. The motors are wound for all commercial voltages and frequencies.

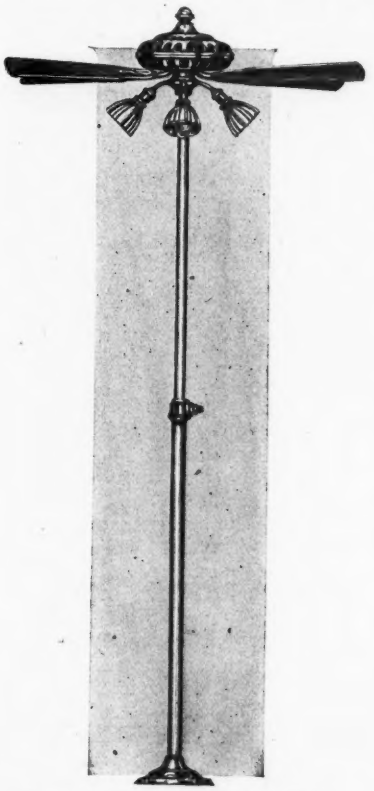
For soda fountains, public dining tables, etc., a combination column fan and electrolier forms an artistic fixture. Such a fan is illustrated. The motor is designed for alternating current and a fifty-two-inch, four-blade fan is used.

Fan-motor design has come to be more or less standard, but certain definite principles are involved in all these fan motors made by the General Electric Company.

Both direct and alternating-current fans have special blade design, a positive trunnion adjustment and liberal lubrication. The latter is so made that oil throwing is impossible.

The fan blades are designed to distribute the air at a wide angle and not deliver it in a straight column, covering a limited area. Humming has been eliminated by carefully balancing and hanging the blades.

Mention has been made of various speeds of fans. This speed variation, in



General Electric Column Fan.

alternating-current motors, is obtained by a six-point reactive coil and switch. In this way the General Electric standard desk or wall bracket type is of well-nigh universal application since it may be operated on slow speeds for the office desk or home and on the higher speeds for stores and halls. Similar speed regulation is obtained in the direct-current type of desk and wall-bracket fans by a self-contained, four-point switch and indestructible resistance, giving three speeds.

All the various types of fan motors which have been mentioned are to be obtained in standard commercial sizes, and for any commercial voltage and frequency. Special windings for operation on odd voltages or frequencies can also be furnished to order if desired. In general the standard finish for General Electric fan motors is black with brass trimmings but this, too, may be varied to meet special conditions, and fans can be decorated to match office fittings or to harmonize with the hardware in private dwellings.

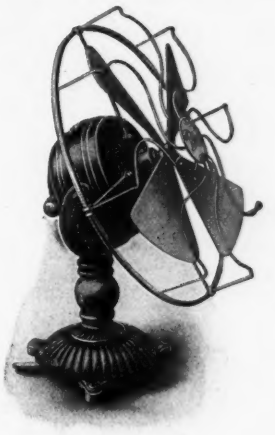
Diehl Fans for 1907.

The Diehl Universal fan, made by the Diehl Manufacturing Company, Elizabethport, N. J., represents advanced ideas in the development of fan motors, combining in one unit three styles, known as the desk, trunnion and bracket types. They may be adjusted to propel the air in any direction and require neither extra parts nor special tools to adapt them to their various positions. In addition to this universal feature the fans have been improved in several points of construction.

The accompanying illustrations show the No. 36 desk fan and the No. 44 ceiling fan.

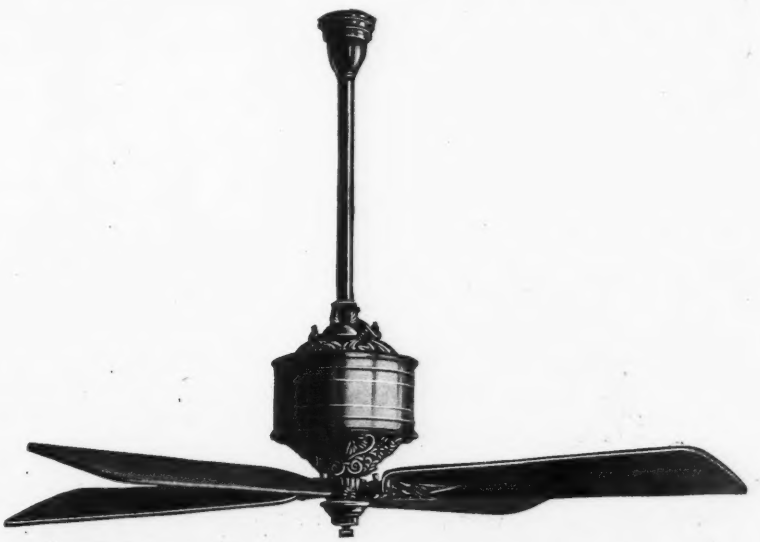
Particular attention has been given to the appearance of the fans as regards compactness, symmetry and finish. The guards are well designed, ornamental and rigid. The trunnions turn on the seat milled on the upper half of the ball, the movement being nearly a circle. A spring acts as a brake and allows the fan to be set at any desired point. The pressure of this spring is great enough to prevent any movement due to the action of the motor or air currents set up by the blades, but it is so adjusted that the direction of the air current may be changed by turning the fan body with the hand.

The No. 44 ceiling fan is of the iron-clad type and presents a neat, compact and symmetrical appearance. The armature core is toothed, and the winding put on by machine. The commutator sections are of hard-drawn copper insulated with mica, and the commutator and core are mounted on a hollow steel shaft. The oiling system is adequate, with no possibility



Diehl No. 36 Desk Fan.

of throwing or dripping oil. The oil reservoirs need filling but once each season. The brush-holders are of the cartridge type, positive in action, and so designed that the brushes are readily accessible. This fan is furnished complete with four blades carried by malleable-iron blade-holders finished in polished nickel. The covers are ornamental castings, and the body is covered by a band finished in japan, beaded, and with gold stripes. This fan runs at a speed of 215 revolutions per minute.



Diehl No. 44 Ceiling Fan.

In addition to the types illustrated herewith the Diehl Manufacturing Company makes a number of other types of fan motors, including column fans, telephone-booth fans and exhaust fans.

The "Stayright" Fixture.

The Stayright Electric Fixture Manufacturing Company, 96 Warren street, New York city, has placed on the market a new electric fixture, the features of which are shown in the accompanying illustrations. This fixture is made of solid steel tubing finished in oxidized copper. It has great strength, combined with lightness, and with its adjustments both at the canopy and at the socket, it can be swung in any direction, extended or contracted, placed at any angle, and adjusted to throw the rays of light directly on the object which it is desired to illuminate.

FIG. 1.—"STAYRIGHT" FIXTURE.

FIG. 3.—CANOPY USED WITH "STAYRIGHT" FIXTURE.

Fig. 1 shows the fixture at an angle, with the lamp placed vertically with respect to the plane to be illuminated. Fig. 2 illustrates the fixture at three different angles, and also at closed and extended lengths. Fig. 3 shows the canopy, illustrating how the cord is coiled without spring or reel.

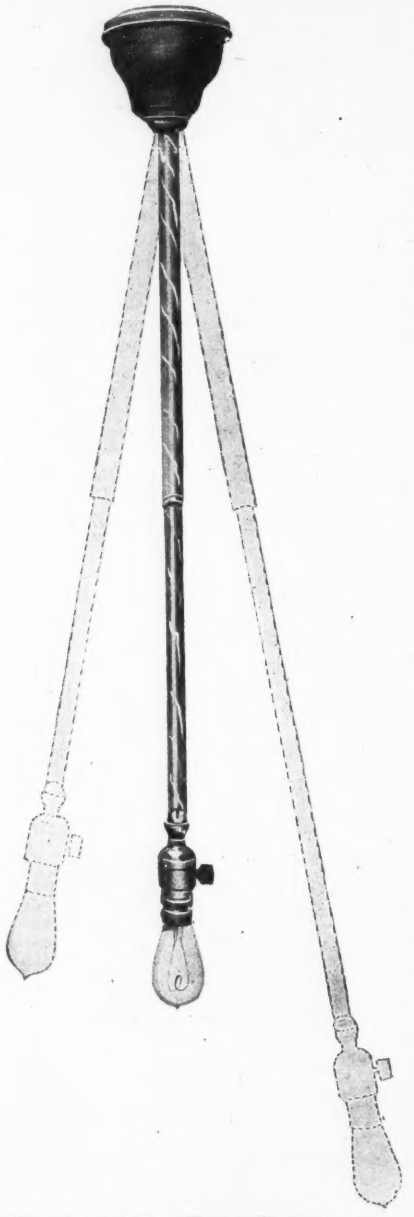


FIG. 2.—SHOWING THREE POSITIONS OF "STAYRIGHT" FIXTURE.

With this fixture one tube telescopes into the other, so that the standard size can be extended from four feet—the normal length—to six feet six inches. The fixture has ball-bearing joints at both the canopy and at the socket. The joints are controlled by friction tension, holding the fixture where put without set screws or other holding devices. The cord is entirely concealed and coils itself in the canopy, taking up the surplus cord when the fixture is telescoped.

A Notable Order for Measuring Instruments.

The Keystone Electrical Instrument Company, Philadelphia, Pa., has recently completed an order for the Signal Corps of the United States Army, the specifications of which are of considerable interest. The Signal Corps issued a specification calling for twenty-four post testing voltmeters to be used in cable testing at its various posts. These instruments were to be standard in size, dead-beat, with equally divided scales, and to give full scale deflection on sixty volts with 100,000 ohms resistance, the resistance to be self-contained in the instrument, and the instrument to be provided with a key for throwing in and out of circuit. It was also specified that the instruments must be accurate within one-half of one per cent. The Keystone Electrical Instrument Company undertook to guarantee an accuracy of one-quarter of one per cent. These instruments were carefully inspected at the company's works by the electrical engineer for the Signal Corps, were accepted, certified and paid for.

The particular interest in these specifications lies in the high resistance called for. It meant the construction of a commercial instrument with pivoted moving coil having a resistance of 1,667 ohms per volt, which meant that the maker had but one-sixteen hundred and sixty-seventh (.000599) of an ampere at its disposal for full scale deflection of ninety degrees. It is believed that these are the most sensitive instruments which have been put into commercial use in the shape of a calibrated instrument with pivoted moving coil. They were constructed on the well-known Deprez-D'Arsonval principle.

A few years ago such a sensibility would have been considered good for a reflecting galvanometer. The ability of the manufacturer to meet these requirements shows how the art of making electrical measuring instruments has advanced.

General Electric to Build at Erie, Pa.

The General Electric Company has purchased 700 acres of land in Erie, Pa., and will build a large plant there. The land extends from the Lake Shore Railroad to the lake front. Work on the buildings will be commenced in the spring.

It is the intention of the company to use 400 acres of the land for the building of comfortable homes for its employés. A model industrial suburb will be built up. Employment will be given eventually to between 4,000 and 5,000 persons. The new plant will not interfere in any way with those already established, but is made necessary by the increase in the company's business.

"A Tale of Two Types."

The Cutler-Hammer Manufacturing Company, Milwaukee, Wis., has published a booklet for the purpose of setting before electric motor manufacturers and other purchasers of starting rheostats certain facts concerning the two types of starting boxes commonly known as "ventilated" and "enclosed." Both kinds are manufactured by this company, and it claims it is therefore in a position to speak advisedly concerning the relative merits and demerits of the two types. The comparison thus set forth is due to certain changes in the rheostat rules proposed by the subcommittee of the electrical committee of the National Board of Fire Underwriters, which will be brought up for discussion and approval at the meeting to be held in New York city on March 28. The recommendation which gives particular offense reads as follows: "For motor-starting rheostats of small or medium size the material of the resistance should be such that it will not change its value with rise of temperature."

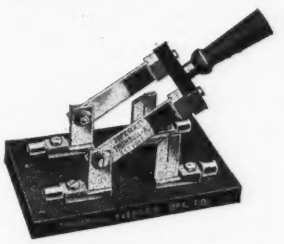
We quote from the pamphlet as follows: "This is equivalent to prohibiting the use of ventilated resistances of small or medium size, because all standard starting rheostats of this type, of whatever make, use iron as the resistance material, and the resistance offered to the passage of the electric current by iron does change with rise of temperature."

Reflecting upon this recommendation, the pamphlet goes on to say: "Starting rheostats using alloys possessing low temperature coefficients as the resistance material are a commercial possibility only when enclosed, and then only because of the small amount of resistance material incorporated in them. If the use of these alloys is made obligatory in rheostats of the ventilated type, the cost of the large amount of higher-priced material called for in constructions of this type will render the further manufacture of ventilated resistances a commercial impossibility."

Concerning the hazard of the ventilated type of starting box, the pamphlet states: "The action of the subcommittee of the National Board of Fire Underwriters in advocating the use of low-temperature-coefficient resistance material in starting boxes is apparently based on the assumption that the fire hazard would be reduced if all starting rheostats were constructed on this principle. It is pertinent, therefore, to enquire how many fires can be traced to starting boxes employing high-temperature-coefficient resistances. It has not been shown (as a matter of fact) that insurance companies have ever lost a single dollar through the use of such resistances, when properly installed."

The New Trumbull Catalogue.

The Trumbull Electric Manufacturing Company, Plainville, Ct., announces that about 45,000 separate switches are to be priced in its new catalogue. This line of switches will include every possible combination of front and back-connected, quick-break, double-break, quick-break and double-break, fused and unfused, plain and polished, direct and alternating

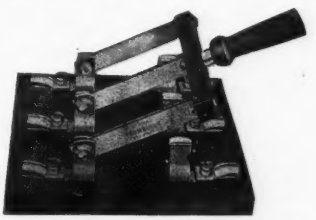


TRUMBULL TYPE "A" SWITCH.

current, from 110 volts to 600 volts, ranging in capacity from fifteen to 2,500 amperes, and covering, in their respective classes, both type A and type C, as shown in the accompanying illustrations.

The company's special department is well equipped to turn out work in the shortest possible time. This is possible because of the great quantity of stock which the company carries.

The design and workmanship of the Trumbull switches meet all the require-



TRUMBULL TYPE "C" SWITCH.

ments of a standard high-grade switch. The devices conform in all points of detail to the specifications of the underwriters. The type A switch, according to tests made recently by the Electrical Testing Laboratories, in New York city, shows exceptional features of reliability.

Flaming Arc Lamps.

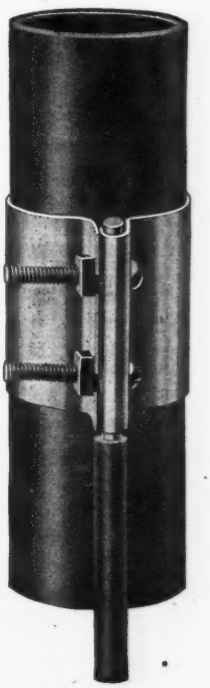
Quite recently there have been installed in New York city equipments of flaming arc lamps manufactured by the Excello Arc Lamp Company, 24-26 East Twenty-first street, New York city, which are attracting a great deal of attention. The Erie Railroad Company has selected this lamp for the illumination of its new terminal at Twenty-third street. The results, particularly as regards lighting efficiency, have been highly satisfactory both to the patrons and officials of the road. The "Excello" flaming arcs are used in this installation both for inside and outside illumination. Similar installations are being made at the Chambers street and Jersey City terminals.

The six "Excello" arcs recently installed at the north mailing platform of the United States Post-office, Park Row, New York city, have demonstrated the luminosity and efficiency of this type of lamp. It is understood that not only the treasury and the engineering department are well satisfied, but the platform operators find that these lamps greatly increase their facilities for working.

"Excello" flaming arcs have also been used for illuminating bulletin signs, a notable example of such an installation being a twenty-five-foot by forty-foot sign on West Thirty-fourth street. This is illuminated by two "Excello" flaming arcs.

A New Ground Clamp.

The Pettingell-Andrews Company, Boston, Mass., has placed on the market a new ground clamp which appears to satisfy every demand for a practical device for



METHOD OF ATTACHING PETTINGELL-ANDREWS GROUND CLAMP.

the attachment of ground wires to either pipe or cable sheaths. The matter of safeguarding electrical service by an efficient grounding system for secondary house wires, metallic conduits and lead-covered sheathes is one which is receiving a great deal of attention. The subject is of such importance that rigid requirements have been prescribed in the National Electric Code. The accompanying illustration shows this ground clamp, and the method of attaching to pipe.

Current Electrical News

DOMESTIC AND EXPORT.

CANADIAN PACIFIC RAILWAY TO UTILIZE WEST KOOTENAY POWER—The Canadian Pacific Railway has become largely interested in the West Kootenay Power and Light Company, Limited, of Rossland, B. C., and will, it is stated, utilize the power developed by the latter in the electrification of several of its mountain divisions.

ELECTRICALLY OPERATED SHOPS FOR THE CENTRAL OF GEORGIA RAILWAY—The Central of Georgia Railway is about to supplant steam power in its Savannah, Ga., works with electricity. It is proposed to install an individual motor for every machine, so that the entire plant will not have to be in operation unnecessarily. The changes to be made will cost $150,000.

DENVER & RIO GRANDE CONSIDERING THE ELECTRIFICATION OF THE SYSTEM—It is announced that the Denver & Rio Grande Railroad officials are considering the use of electric power, furnished by the Central Colorado Power Company, of Colorado Springs, Col. Work will be carried out along the general plan adopted by the New York Central & Hudson River Railroad Company.

TO ERECT LARGE POWER PLANT NEAR TACOMA—Manager E. J. Felt, of the Pacific Traction Company, has announced that his firm will, in a short time, begin the erection of a 40,000-horse-power electric plant in or near Tacoma, Wash. The site has been purchased, but the location is being withheld for the present. The power developed will be used in the city, and other lines in which the company is interested will be completed.

STOCK INCREASE AUTHORIZED—The New York state railroad commissioners have approved of an increase in the capital stock of the Buffalo & Lake Erie Traction Company from $6,750,000 to $7,500,000. The company is to operate a street railroad between Buffalo and Erie, N. Y. The purpose of the increase is to acquire the Jamestown, Chautauqua & Lake Erie Railway Company. The company has already acquired several roads between the two points named.

NEW TRACTION CONSOLIDATION—The Cleveland, Southwestern & Columbus Railway Company, capitalized at $10,000,000, has been incorporated by a consolidation of the Cleveland & Southwestern Traction Company, the Cleveland, Ashland & Mansfield Traction Company and the Ohio Central Traction Company. The consolidation gives the Pomeroy-Mandelbaum interests a direct line from Cleveland, Ohio, *via* Wooster and Mansfield, to Bucyrus, from which place they will reach Columbus over the line of the Columbus, Delaware & Marion Company.

BELL TELEPHONE COMPANY OF CANADA—The Bell Telephone Company of Canada reports that its net earnings for the year ended December 31, 1906, aggregated $992,855, an increase of $90,537 over those for the previous year, while its surplus was $266,178, compared with $252,103 at the close of 1905. From the surplus, however, $205,141 was charged off for contingent fund, accident reserve and insurance reserve, leaving a balance of $61,037, carried to the profit and loss surplus. At a special meeting of the company a bond issue of $3,750,000 was authorized by the shareholders.

MINNESOTA POWER PROJECT—An electric light and power company has let a contract for the machinery to develop the water power in the Mississippi River eight miles east of Bemidji, Minn., the power generated to operate manufacturing plants in Bemidji. An act has been passed by Congress granting the right to build a dam on the power site and the plans approved by the secretary of war. It is estimated that 25,000 horse-power can be developed. This will be transmitted to the city by means of a high-tension line eight miles in length. Right of way 100 feet wide has been secured from the site of the plant to the city limits.

NEW CONNECTICUT COMPANY INCORPORATED—A certificate of incorporation has been filed in the office of the secretary of the state of Connecticut by the Susquehanna Railway, Lighting and Power Company, of Hartford, Ct., the incorporators being Lucius F. and John T. Robinson and Albion B. Wilson. The company may issue capital stock to the amount of $20,000,000. Its business may be carried on anywhere in the world. It may deal in stocks and bonds; may manufacture and sell and operate any and all sorts of vehicles, may operate electric light plants or plants for the generation of electricity; may establish water systems and any form of system necessary to dispose of the by-product of any of its other forms of operation.

CHEAP POWER FOR LA CROSSE, WIS.—It is announced by the La Crosse Gas and Electric Company that it has closed a contract with the La Crosse Water Power Company for the distribution of power throughout the city of La Crosse. Contracts for a plant to be built at Hatfield, including the dam, canal, power-house and all other apparatus, as well as the construction of the pole line from Hatfield to La Crosse, have been signed and actual work begun, with the expectation that power will be delivered in La Crosse within eight months. The dam will be of the solid concrete type, 520 feet long and fifty feet high, with spillway 300 feet wide. The canal leading from the dam to the power-house will be about two miles long, with a width of seventy-five feet and a depth of thirteen feet.

LARGE ELECTRICAL DEVELOPMENT PLANNED—The Electrical Properties Company, along with Westinghouse, Church, Kerr & Company and other parties, have completed arrangements for the rapid development of a large water power at the Anthony Shoals on Broad River, at a cost of between $4,000,000 and $6,000,000. The shoals are located sixty-five miles from Augusta, Ga., between Wilkes and Elbert counties, and it is estimated 40,000 horse-power will be available. The same interests are in control of the Ringjaw Shoals Company, but all the first work of development will be directed to the first-mentioned property. The company is already under contract to deliver power in Augusta by July, 1908, and the plans will be pushed forward very rapidly in order that the delivery may be effected. It also has contracts with Washington and other cities.

HIGH-SPEED ELECTRIC ROAD—The state railroad commission has granted permission to the proposed West Shore Traction Company to construct a high-speed electric road, twenty-five miles long, from Tomkins Cove down along the Hudson river to the state line at Cartaret, Rockland county, N. Y., passing through ten villages. The company has a capital of $250,000 and is being promoted by Searing & Company, bankers, of New York city, who were the backers of the new Delaware & Eastern steam road, which was granted authority to construct a line from the Pennsylvania coal fields to Schenectady recently by the state commission. It is reported that the West Shore Traction Company will extend its line from the state line fifteen miles through the state of New Jersey to Jersey City and will eventually enter New York city through the McAdoo tunnel.

HAVANA ELECTRIC RAILWAY COMPANY—At the annual meeting of the Havana Electric Railway Company an entirely new board of directors was elected and an investigation of the financial condition of the company by expert accountants was ordered. The Cuban interests in the company have been represented here by Frank Steinhart, consul general for the United States at Havana. Instead of being represented on the board by one director they now have four of the eight directors. Mr. Steinhart, who has sent in his resignation as consul and is to act as the Cuban representative of Speyer & Company, said that the investigation did not necessarily indicate any criticism of the old directors, but was merely to give the new management a better understanding of the company's finan-

cial situation. The company has a surplus of several thousand dollars. The new directors are Robert Mather, president of the Rock Island; Walter G. Oakman, Warren Bicknell, David T. Davis, James Rattray, Antonio San Miguel, Henry Runken, Carlos Zaldo, president of the Bank of Havana, and Frank Steinhart. The following officers were elected: Warren Bicknell, president; David T. Davis, vice-president, and Mr. Ashley, secretary and treasurer.

MEXICAN ELECTRICAL NOTES—The town of San Pedro, Coahuila, will shortly be connected with Torreon by a street-car line. Surveys for this new road are already being made by the engineers. The road when completed will be about five kilometres in length and will extend through the town of San Pedro. Another electric light and power plant is being projected for Saltillo. Northern capitalists are interested in the undertaking, together with E. Hermann, of Saltillo. An electric light and power plant, in which Alfred Lilliandahl, of Saltillo, is interested, and for which a valuable concession has been granted by the government, is also being contemplated. This last-named concern will use the waters of the Choro de Agua near Arteaga, Coahuila, to furnish power. New Jersey capitalists are largely interested in this last undertaking. Eventually it is the plan of the promoters to put down an electric railway between Saltillo and Arteaga and the rich agricultural country beyond. S. P. Applewhite, of Mexico City, has entered into a contract for the development of electric power on the Rio Grande, district of Cuicatlin, state of Oaxaca. Mr. Applewhite has the right to transmit electrical energy to any point he may find desirable. It is his intention to supply power and electric lighting to the city of Oaxaca and to the different mining camps in that region, principally in the district of Taviche. The development of the project will be started at an early date. The concession carries with it the usual franchises, such as the free importation of all materials, machinery, etc., exemption from taxation, the free use of government lands, etc.

ELECTRIC LIGHTING.

NEW ROADS, LA.—At a recent meeting the mayor was authorized to secure estimates for the installation of an electric light plant.

FINDLAY, OHIO—Arlington has voted to buy the electric light plant and to improve same. Bonds to the amount of $15,000 will be issued for this purpose.

GAYLORD, MICH.—The village council has voted to install a new Corliss engine at a cost of $2,500 to replace two smaller ones now operating the municipal lighting plant.

ABERDEEN, S. D.—The city council has awarded the electric light bonds to the value of $35,000 to the Harris Trust and Savings Company, of Chicago, whose bid was $35,658.

REEDSVILLE, WIS.—Reedsville has voted for a municipal lighting plant, the same to be operated in connection with the waterworks system recently erected at a cost of $8,000.

SUSQUEHANNA, PA.—The Erie Railroad Company will install an electric plant at Susquehanna for its own lighting purposes and for the running of various machines by electricity.

ALEXANDRIA, LA.—The city has voted the issuance of $16,000 bonds for extending sewerage system, $7,000 for extending waterworks and $2,000 for extending electric light system.

ANNISTON, ALA.—The plant of the Anniston Electric and Gas Company will be doubled in size and capacity without delay. This work will be done prior to the development of water power for electrical purposes and is independent of such development.

CAMDEN, PA.—At the annual meeting of Camden city council a committee submitted a voluminous report on the proposed erection of a municipal lighting plant. The committee stated that such a plant will cost about $180,000 and can be erected within one year.

STEAMBOAT SPRINGS, COL.—At a meeting of the board of trustees a petition was received from a company composed of Denver and Steamboat Springs people asking for a franchise for electric light and power and gas and fuel service for Steamboat Springs and vicinity.

SISTERVILLE, W. VA.—George W. Hunter, M. F. Noll, W. E. Roe, Logan A. Noll, C. W. Fowling and James A. Griffin are the incorporators of the Williamstown Water, Light and Power Company, which has an authorized capital stock of $50,000, of which $5,000 has been paid.

NEWARK, N. J.—James M. Seymour has been selected as supervising engineer, to construct and install an electric lighting plant in the new City Hall, under the direction of the common council committee on municipal lighting. It is estimated that the plant will cost about $25,000.

COLORADO SPRINGS, COL.—An ordinance authorizing an election on April 2, for the purpose of voting $30,000 in bonds for the erection of a municipal electric light plant and an ordinance authorizing the expenditure of $150,000 for the construction of an electric light plant by the city, have been passed by the city council.

NASHVILLE, TENN.—The board of public works has advertised for bids on $13,000 worth of supplies to be used by the city electric light department. The bids will be opened within the month. The action of the council in passing on third reading two measures gives the board authority to purchase $7,000 worth of wire, poles, cross-arms, etc., and $6,000 worth of arc light materials.

JOPLIN, MO.—A franchise granting the Joplin Light, Power and Water Company the right to lay conduits and hang overhead wires in Joplin for the conduction of electric current has been introduced in the city council. The Joplin Light, Power and Water Company asks for a twenty-year franchise in Joplin and all privileges necessary to the construction and maintenance of an electric light system.

NEW HAVEN, CT.—The Central Massachusetts Electric Light Company, of Palmer, has passed into the hands of the New York, New Haven & Hartford Railroad Company. A controlling interest has been sold to the New England Security and Investment Company, of Boston. The stock of the Investment company is to be exchanged for stock of Central Massachusetts Electric Company at $40 a share.

BELLEFONTE, PA.—Joseph M. Woods and James Woods, of Huntingdon, and Wallace Wilson, of Alexandria, are securing extensive water rights in this part of the state. They have obtained all the leases necessary to enable them to put up a power plant on Penn's creek, in the neighborhood of Lindale. It is proposed to build a dam below Lindale, from Little to White Mountain, entirely closing up the gorge.

MARINETTE, WIS.—William Holmes, of Menominee, owner of property at Grand Rapids on the Menominee river and possessor of the legislative grants of Michigan and Wisconsin for the construction of a dam for the development of electric power, is making contracts with local manufacturers for the furnishing of electric power to them. He proposes to proceed at once to build a plant and transmit power to both Menominee and Marinette.

DETROIT, MICH.—The budget of the public lighting commission, filed with the controller, provides for a total of $385,596. The board of estimate last year allowed $193,557.04. There is a general increase in the demands of the department, but the greatest item is for a new turbo-unit, to cost complete $63,432, which would practically mean the doubling of the capacity of the plant. The sum of $21,000 is asked to replace 400 old Brush lamps with new enclosed alternating-current arcs.

ALBANY, N. Y.—Moderate gains in gross and net earnings have been recorded by the Hudson River Electric Power Company for the fiscal year ended January 31, 1907. Gross earnings for the twelve months in question aggregate $917,684, compared with $754,642 in the previous year, thereby registering an increase of $163,042. Expenses involved $537,558, compared with $412,824 in the previous year, showing a gain of $124,734, and net earnings amounted to $380,126, or $38,308 more than those for the preceding year, when the net earnings aggregated $341,818.

MILWAUKEE, WIS.—It is stated that Milwaukee will carry on a commercial lighting business in addition to lighting the city streets, when the municipal lighting plant has been completed. The original proposition only included street lighting in order to save money to the city. It has been found, however, that there is so great a demand for light from the public that the committee having the erection of the plant in charge has changed the first plans so as to give more power, which will enable the city to furnish commercial light to any one who wishes it. Work on the new plant will be commenced in the spring and it is hoped that another year will see it installed.

NEW INCORPORATIONS.

VINCENNES, IND.—Wabash Home Telephone Company. Capital increased from $25,000 to $40,000.

MADISON, WIS.—Montello Farmers' Telephone Company, Montello, Marquette county. $7,000. Incorporators: John Foster and four others.

SPRINGFIELD, ILL.—Northwestern Telephone and Telegraph Company, Freeport. $30,000. Incorporators: C. B. Cheadle, Frank Zinnel and L. A. Herrick.

AUSTIN, TEX.—Western Light and Power Company, of Cisco, Eastland county. $50,000. Incorporators: W. E. Anderson, M. V. Mitchell, W. A. McSpadden.

LOS ANGELES, CAL.—Compton Electric Light and Power Company. $50,000. Directors: Byron L. Oliver, G. R. Fulton and E. R. Pottinger, all of Los Angeles.

MADISON, WIS.—Rock River Telephone Company, Johnson Creek, Jefferson county. $10,000. Incorporators: W. A. Christians, E. A. Seitz and Eugenia L. Christians.

SPRINGFIELD, ILL.—Mississippi Valley Telephone Company. Authorized to change location from Marshall to Paris and to increase capital from $125,000 to $400,000.

MADISON, WIS.—The Sparta-Melrose Electric Railway & Power Company, of Sparta. $300,000. To build an electric interurban line between Sparta and Melrose, a distance of twenty miles.

HARRISBURG, PA.—North Manheim Township Electric Light, Heat and Power Company, Palo Alto; $5,000. Orwigsburg Electric Light, Heat and Power Company; $5,000. West Elizabeth Electric Company, Pittsburg; $5,000. Craig Electric Company, Pittsburg; $5,000. Dravasburg Electric Light Company, Pittsburg; $5,000.

ATLANTA, GA.—Atlanta, Stone Mountain & Lithonia Railway Company. To build a line about twenty miles long from Decatur in De Kalb county through the towns of Ingleside, Clarkston, Scottdale and Stone Mountain to Lithonia. $50,000. Incorporators: A. O. Venable, A. B. Kellogg, R. M. Thompson, S. H. Venable and others.

HELENA, MONT.—The Dell Telephone Company. $10,000. Directors: H. Clay Patterson, Frank Nelson, Harry Andrews, Henry Thompson, Walter Crowell, Edgar Kennison, E. M. Martinell, of Dell, and O. C. Gossman and Robert Schendell, of Lima. To construct and maintain a telephone system from Dell, Beaverhead county, to the Sheep Creek Basin and vicinity.

MENOMINEE, MICH.—The Holmes Lighting and Power Company. $350,000. Incorporators: Herman Holmes, of Crystal Falls; William Holmes, of Menominee; Guy Holmes, of Marinette, and Herbert A. Bowdish, of Fond duc Lac. Formed for the purpose of improving the water power at the Grand Rapids of the Menominee river to generate electricity for power, light and heat.

NEW MANUFACTURING COMPANIES.

FRANKFORT, KY.—Incorporation articles have been filed by the Phillips Signal and Electric Company, Owensboro, with $50,000 capital stock. C. C. Phillips, J. R. Tennelly and W. F. Hayes are the incorporators.

BALTIMORE, MD.—The Kirk-Habicht Company, organized to deal in electrical supplies and iron and brass merchandise, has been incorporated by Charles E. Kirk, William C. Habicht, George W. Wilson, Arthur A. Bregel and George A. Solter. The capital stock is $5,000.

ALBANY, N. Y.—The Rochester Electric Specialty Company of Rochester has been incorporated with a capital of $15,000. The directors are J. E. Smith, of Brighton; W. S. Humphrey, H. H. Widener, E. J. Brooks, George J. Gillies, of Rochester; R. O. Hannan, of Jamestown, and D. McCall Brooks, of Gates.

EDUCATIONAL NOTE.

CLARKSON MEMORIAL SCHOOL OF TECHNOLOGY—The Thomas S. Clarkson Memorial School of Technology, Potsdam, N. Y., will celebrate the eleventh anniversary of the granting of the charter by the University of the State of New York, on the eve of charter day, March 18, in chapel hall, at eight o'clock. An address will be delivered by Frederick Remsen Hutton, president of the American Society of Mechanical Engineers.

NEW PUBLICATIONS.

PROCEEDINGS OF THE RAILWAY SIGNAL ASSOCIATION—The proceedings of the Railway Signal Association for the year 1906 have been published in book form, making up Vol. IX. This volume includes a list of members, and the papers presented, together with the discussions thereon, at the several meetings which took place during the year. The annual meeting of the association will be held at Milwaukee, Wis., October 8 to 10, 1907.

STANDARD FORM OF REPORT FOR ELECTRIC RAILWAYS—The standard form of report for electric railways prepared by a committee of the Street Railway Accountants' Association of America, and approved by that association at Detroit, Mich., October 10, 1902, and adopted as standard by the National Association of Railroad Commissioners at Portland, Me., July 16, 1903, has been printed and distributed by the Street Railway Accountants' Association.

ANNUAL REPORT OF THE SMITHSONIAN INSTITUTION—The annual report of the board of regents of the Smithsonian Institution, Washington, D. C., for the year ending June 30, 1905, has been issued. This contains the usual reports of officers and committees, and a general appendix containing reprints of important articles of scientific interest. Those relating to electrical engineering are as follows: "Photographing Lightning with a Moving Camera," by Alex Larsen; "The Tantalum Lamp," by W. Von Bolton and O. Feuerlein; "Progress in Radiography," by L. Gastine, and "Luminosity in Plants," by Hans Molisch.

DERRICK'S BRITISH REPORT—This new publication "Derrick's British Report," published monthly by Paul E. Derrick, 34 Norfolk street, Strand, London, England, is "devoted to the detailed analysis and exploitation of a foreign market for the benefit of American manufacturers of proprietary goods of all sorts." The matter shows careful preparation, is interesting and seems to be based upon accurate knowledge and a good fund of common sense. If the editors have not exhausted their fund of information in the first number, the following issues should be of interest and benefit to this class of manufacturers. The price per copy is four shillings, £2 for twelve numbers.

LEGAL NOTE.

SPLIT-PHASE WATTMETER DECISION—The United States Circuit Court of Appeals in Chicago filed an opinion on January 31 last in the case of the Westinghouse Electric and Manufacturing Company *versus* the Diamond Meter Company. In this suit, brought for infringement of Tesla patents No. 511,559 and No. 511,560, the court below granted injunctions against the Diamond Meter Company, stopping its manufacture and sale of alternating-current indicating wattmeters commonly known to the trade as "Scheeffer Meters," and the present opinion of the Court of Appeals affirms the action of the lower court in placing the Diamond Meter Company under injunction. This decision is the last of a long series of favorable decisions, and places the validity of these patents and their applicability to split-phase meters for power purposes beyond question. The opinion gives full credit to Mr. Tesla for the invention of the split-phase idea of operating meters, giving the Westinghouse Electric and Manufacturing Company and the General Electric Company and their associated companies exclusive right to manufacture and sell split-phase alternating-current induction wattmeters.

DATES AHEAD.

Railway Signal Association. Chicago, Ill., March 18.

Underwriters' National Electric Association. Annual meeting Electrical Committee, New York city, March 27-28.

Ohio Independent Telephone Association. Annual convention, Columbus, Ohio, March 28.

West Virginia Independent Telephone Association. Wheeling, W. Va., April.

Iowa Electrical Association and Iowa Street and Interurban Railway Association. Annual meeting, Clinton, Iowa, April 18, 19 and 20.

Southwestern Gas, Electric and Street Railway Association. San Antonio, Texas, April 18-21.

Jamestown Tercentennial Exposition. Norfolk, Va., April 26 to November 30.

Texas State Electric and Gas Association. San Antonio, Texas, May 14-16.

American Society of Mechanical Engineers. Annual meeting, Indianapolis, Ind., May 28-31.

National Electric Light Association. Annual meeting, Washington, D. C., June 4, 5, 6 and 7.

Association of Railway Telegraph Superintendents. Annual meeting, Atlantic City, N. J., June 19-20.

PERSONAL MENTION.

MR. J. S. ANTHONY and Mrs. Anthony sailed on the steamer Bermudian on March 2. They will remain at the Hamilton Hotel, Bermuda, for several weeks.

MR. E. G. ACHESON, the well-known inventor of carborundum, passed through New York city with his son during the week, on his way from Havana to Niagara Falls.

MR. W. BRANCH WAINWRIGHT, for several years district manager of the Diamond State Telephone Company, Dover, Del., will succeed A. Talbot Cole as general traffic manager.

MR. A. A. ANDERSON, general manager of the Indianapolis, Columbus & Southern Traction Company, is to assume control of the road now building between Indianapolis, Ind., and Louisville, Ky., as soon as the cars are in operation.

MR. CHARLES H. HILL, who has been chief engineer of the Northampton (Mass.) electric light station for a number of years, has accepted the position of assistant superintendent of the Poughkeepsie (N. Y.) Light, Heat and Power Company. He has been succeeded by Frank A. Gorrow.

MR. GEORGE A. REDMAN, a well-known electric light man, formerly prominent in electric lighting developments in Rochester, N. Y., and now a resident of De Land, Volusia county, Fla., was the winner of a nine-hole handicap golf match played at the College Arms Grounds, De Land, on Saturday, February 16.

MR. B. A. HOAG, who for the past six months has held the title of superintendent of transportation of the Fort Smith (Ark.) Light and Traction Company, will hereafter be superintendent of the entire street-car system and have charge of its operation and maintenance. Mr. Hoag previous to coming to Fort Smith was for thirteen years connected with the street-car system of Kalamazoo, Mich.

MR. J. R. LOVEJOY has been appointed general manager of the sales department of the General Electric Company. Mr. Lovejoy has long been known to the electrical fraternity, and this title is a formal recognition of the responsibilities with which he has practically been charged for the last two or three years. Mr. Lovejoy was born at Columbus, Ohio, in 1863. After a post-graduate course at the Ohio State University, from which he received the degree B.Sc., he entered the employ of the Thomson-Houston Electric Company at Lynn, Mass., August, 1886. Here he gained his practical experience and graduated from what was then known as the "expert course" to take up engineering work in the Boston office of the company. Later his time was devoted to executive duties at headquarters, and when the Thomson-Houston Company was merged into the General Electric Company, in 1892, he became general manager of the supply department. In 1900 he was made also manager of the railway and lighting departments of the General Electric Company. He is an officer and a director in several subsidiary companies. Mr. Lovejoy is a director and a member of the executive committee of the Schenectady Trust Company and was one of the organizers of that concern. He is also a member of the American Institute of Electrical Engineers, the Franklin Institute and the American Society for the Advancement of Science, as well as several organizations pertaining to electrical science. In addition to his diversified duties Mr. Lovejoy finds time to take an active part in promoting the welfare of the Mohawk Golf Club, of Schenectady, of which he is president. He is also a member of the Mohawk Club of Schenectady and the University Club of New York. For many years Mr. Lovejoy has been interested in the subject of archæology so far as it is related to implements of the Stone Age, particularly Indian arrow heads, of which he has made a noted collection. Mr. Lovejoy's home and principal office is still situated, as for several years past, at Schenectady.

OBITUARY NOTE.

MR. GEORGE G. MARTIN, for six years district superintendent of the Bell Telephone Company in Arkansas, died on February 24 at the home of his father, George Martin, Webster Grove, Mo. He had been ill for three months. The deceased was born in New Orleans in 1871. He graduated from Smith Academy in 1889 and from Yale four years later. He represented the Bell interests in Indianapolis, Ind., for four years and was transferred to Arkansas in the latter part of 1900.

ELECTRICAL SECURITIES.

The price movement during the past week has been very irregular, with alternating up and down movements, developing, on several days, a demoralized and semi-panicky condition. Compared with a week ago, the list shows, in general, many declines. Despite the aspects of the present market, it is confidently asserted by many conservative interests that the present shake-down will, in the end, prove of great benefit to the country at large. The conditions to-day are similar in many ways to those which existed just prior to the business demoralization which took place in 1903. Compared with 1903, however, 1907 will, without doubt, show considerable industrial development, the reaction being along the lines of improving the stability of those interests which will weather the present discounting process.

ELECTRICAL SECURITIES FOR THE WEEK ENDING MARCH 9.

New York:	*Closing.*
Allis-Chalmers common	12¾
Allis-Chalmers preferred	32
Brooklyn Rapid Transit	57⅝
Consolidated Gas	125
General Electric	150
Interborough-Metropolitan common	25⅝
Interborough-Metropolitan preferred	62¼
Kings County Electric	130
Mackay Companies (Postal Telegraph and Cables) common	69⅜
Mackay Companies (Postal Telegraph and Cables) preferred	68
Manhattan Elevated	137
Metropolitan Street Railway	100
New York & New Jersey Telephone	112
Western Union	80
Westinghouse Manufacturing Company	145

The directors of the General Electric Company have declared a quarterly dividend of $2 a share on the stock. The dividend is payable April 15 to stockholders of record March 14.

Directors of the Interborough-Metropolitan Company have declared the regular quarterly dividend of 1¼ per cent on the preferred stock. The dividend is payable April 1. Books close March 18 and reopen April 1.

The regular quarterly dividend of 1¾ per cent on Manhattan Railway stock paid as rental by the Interborough Rapid Transit Company for this quarter will be payable April 1. Books closed March 15 and will reopen March 27.

Directors of the Interborough Rapid Transit Company have declared the regular quarterly dividend of 2¼ per cent, payable April 1 to holders of voting trust certificates of record March 18. Books close March 18 and reopen April 1.

Directors of the Mackay Company have declared the regular quarterly dividend of 1 per cent on the preferred stock and 1 per cent on the common stock of that company, payable April 1 to stock of record March 16. Books close March 16 and reopen April 1.

Boston:	*Closing.*
American Telephone and Telegraph	124
Edison Electric Illuminating	215
Massachusetts Electric	65
New England Telephone	118
Western Telephone and Telegraph preferred.	72

Directors of the American Telephone and Telegraph Company have declared the regular quarterly dividend of 2 per cent on the stock, payable April 15 to stock of record March 16. Books close March 17; reopen April 1.

Stockholders of the Edison Company of Boston have voted to increase the stock from $11,494,100 to $12,643,000. The directors offer to stockholders of record March 6, 1907, 11,495 shares at $215 per share, at the rate of one new share for every ten old shares. The right to subscribe will expire March 25. Shares not subscribed for as above will be sold at auction. Payment must be made at the rate of $215 per share, as follows: $100 per share on April 15, 1907, and $115 per share on June 3, 1907.

Philadelphia:	*Closing.*
Electrical Company of America	9¾
Electric Storage Battery common	56
Electric Storage Battery preferred	56
Philadelphia Electric	7⅞
Philadelphia Rapid Transit	20
United Gas Improvement	88½

Books of the Philadelphia Electric Company will close March 22 for the annual meeting and reopen April 1.

Chicago:	*Closing.*
Chicago Telephone	117
Chicago Edison Light	135
Metropolitan Elevated preferred	66
National Carbon common	78
National Carbon preferred	115¼.
Union Traction common	—
Union Traction preferred	—

Chicago Telephone gained 2,696 telephones during February, the total now in use being 176,669.

TELEPHONE AND TELEGRAPH.

MOUNT PENN, PA.—The Consolidated Telephone Company, of Pennsylvania has completed its line through Mount Penn.

ALBANY, N. Y.—At the annual meeting of the stockholders of the Hudson River Telephone Company the retiring directors were reelected, except that Samuel M. Green, of Brooklyn, was elected in the place of Thomas Sherwin.

CARROLLTON, GA.—It has been announced by the officers of the Gainesboro Telephone Company and the management of the Southland hotel that a contract has recently been signed by the two companies whereby a common battery switchboard is to be installed as a private branch exchange at the Southland hotel.

PITTSBURG, PA.—An increase in capital stock issue of $2,000,000, to care for proposed extensions and present floating indebtedness, was authorized at the annual meeting of stockholders of the Central District and Printing Telegraph Company. The company has an authorized capitalization of $15,000,000, of which but $11,000,000 has been issued in stock. Half the $4,000,000 stock surplus now in the treasury will be issued. In February, 1904, stockholders agreed to a stock increase of from $10,000,000 to $15,000,000, but only $1,000,000 worth has been placed on the market. The company has no bonds and as the assets, as given in the annual report, were fixed at $13,932,151.11, it seems to be prosperous on an $11,000,000 stock issue. Dividends paid during the year, at the rate of eight per cent, total $860,000, while $92,753.68 was added to surplus account during the year, making total surplus $673,325.37. Of the 110,000 shares issued 103,334 were voted at the meeting. The old board of directors was reelected, as follows: D. Leet Wilson, D. F. Henry, George I. Whitney, D. H. Wallace, William B. Schiller, J. B. Finley and Henry C. Bughman, of Pittsburg, and F. P. Fish and C. Jay French, of Boston. The directors organized by reelecting former officers.

PHILADELPHIA, PA.—Many important improvements, including the erection of a large general office building at Broad and Spruce streets, at a cost of $1,500,000, were planned at the yearly meeting of the board of directors of the Bell Telephone Company. The new building, which is intended to replace the present offices at Seventeenth and Filbert streets, will contain the general and central offices of the company, and will be equipped with all of the most modern improvements known to the telephone field. As the present building will shortly be acquired by the Pennsylvania Railroad Company, work on the new office building will probably be started in October and will be pushed to a speedy completion. The officers elected were: U. N. Bethell, president; F. H. Bethell, vice-president; W. S. Piersol, secretary and treasurer; W. J. McLaughlin, auditor, and P. L. Spaulding, general manager. H. A. Richardson was elected to the board of directors. Mr. Richardson founded the Diamond State Telephone Company, and has been long identified with telephone interests. He was elected to represent his own and other large interests, the Bell having acquired control of the Diamond State. The board now consists of Charles F. Cutler, chairman, Morristown, N. J.; U. N. Bethell, Montclair, N. J.; Frank H. Bethell, Thomas E. Cornish, Richard M. Elliot, Philadelphia; Frederick P. Fish, Boston, Mass.; Edward J. Hall, Morristown, N. J.; H. S. Huidekoper, James E. Mitchell, Francis B. Reeves, Philadelphia; H. A. Richardson, Dover, Del., and Thomas Sherwin, Boston, Mass. The directors appropriated $3,600,000 for extensions and additions to plant to take care of new business. Among the new buildings to be erected in Philadelphia during the year in addition to the new office building are the Dickinson central office, under way; Woodland central office, under way, and the Diamond central office, planned. The additions to the Delaware & Atlantic service will include central office buildings at Ardmore, Pa.; Haddonfield, N. J.; Lansdowne, Pa.; Norristown, Pa.; West Chester, Pa., and Wilmington, Del. The last-named building is now under way. The annual report shows that the company has 95,914 stations in Philadelphia and 68,297 stations at various points on its lines, representing a net gain of 25.6 per cent in Philadelphia and 41.1 per cent elsewhere since January 1, 1906. The net earnings for 1906 show an increase of $390,111.86 over 1905, while the increase in dividends was $342,352.50. The total receipts were $5,501,313 and the expenses $3,721,625, making a gross income of $1,779,687. Interest charges were $111,013 and dividends $1,241,421, leaving $427,253 for the surplus account, which now amounts to $1,268,493.

ELECTRIC RAILWAYS.

PHILADELPHIA, PA.—The Market street elevated line was opened on March 4.

NASHUA, N. H.—The state Supreme Court has handed down a decision granting the right of incorporation to the Derry & Goffs Falls Electric Railway Company, which petitioned under the general laws.

ROCHESTER, N. Y.—The engineering department of the Rochester Railway Company has in preparation plans for the construction of twenty miles of additional track in different sections of the city.

SPRINGFIELD, MO.—Springfield and Carthage capitalists have revived the project to connect the two towns with an electric railway, and it is generally believed that preliminary work will be inaugurated soon.

PROSSER, WASH.—The city council has granted a franchise to the Prosser Traction Company, a local concern proposing to build an electric railway to the North Coast railroad, a mile and a half north of Prosser; also to the Columbia river on the south, to connect on the north with a road from Priest Rapids, to be built by the Hanford Irrigation Company, and to suburban points.

HATTIESBURG, MISS.—F. A. Camp, president of the Hattiesburg Traction Company, announces that the contract is to be awarded for the building and equipping of the power plant and the completion of track construction on the Hattiesburg street railway. The rails are being put down by the traction company itself, but the rest of the construction will be done by contract, along with the equipping of the power plant.

YONKERS, N. Y.—The Bronx, Yonkers & White Plains Railroad nas been granted a franchise by the Yonkers board of aldermen to extend the line eleven miles from Yonkers, to White Plains village. The company showed the consent of nearly all the property holders along the route, the consents being given, it is said, on the promise of the railroad company to carry all school children for a three-cent fare. The company is backed by the Everett Moore syndicate, of Cleveland, Ohio.

SPOKANE, WASH.—The application of the Spokane & Inland Empire railway system for a franchise to build a million-dollar subway on Main and Front avenue, to connect the freight terminal with the main passenger station, a distance of nearly a mile, has been granted by the city council of Spokane, and it is given out that work will begin in a short time. The subway will be double tracked, thirty feet deep, built of concrete and stone. The franchise provides that it must be completed in five years.

HARRISBURG, PA.—Articles of merger and consolidation between the Hagerstown & Northern Railway Company, of Maryland, and the Franklin County Railroad Company, have been filed in the state department. The Hagerstown & Northern road runs from Hagerstown to Reid, near the state line. The Franklin county line runs from Reid to Shady Grove, Franklin county. The name of the consolidated road is the Hagerstown & Northern, and the capital is $250,000. Christian W. Lynch, of Harrisburg, is the president.

CLINTON, IOWA—The Rock Island Construction Company, which, it is understood, has been formed to continue the construction of the Rock Island Southern Railway from Galesburg to Rock Island, has been incorporated. The capital stock of the new company is $500,000, the right being reserved to increase the capital to $2,000,000. The articles allow the company to build and acquire electric or steam railroads and coal lands. The officers and directors are: president, G. H. Higbee, of Burlington; vice-president, E. C. Walsh, of Clinton; treasurer, C. H. Walsh, of Burlington; secretary, J. W. Walsh, of Davenport.

GALVESTON, TEX.—Eastern capitalists, headed by the Stone & Webster syndicate, of Boston, have closed a deal for the construction of an electric interurban road connecting Galveston and Houston, fifty miles; for building twenty miles of side lines to towns on Galveston bay in Texas, and also for a seventy-five mile electric road between New Orleans and Baton Rouge, the syndicate having bought the Baton Rouge street railways. Stone & Webster now own the electric street railways in Dallas, Forth Worth, Houston, Galveston and El Paso and the interurban line connecting Dallas and Fort Worth. The Texas legislature has passed a bill giving interurban electric railway companies the right of eminent domain. The bill was drawn especially in the interest of the above electric railway.

INDUSTRIAL ITEMS.

THE DAYTON MANUFACTURING COMPANY, Dayton, Ohio, in catalogue No. 139, describes and illustrates the "Silvey" storage battery.

THE SACHS COMPANY, Hartford, Ct., is publishing an elaborate catalogue devoted to electrical protective devices for any voltage.

THE NATIONAL CARBON COMPANY, Cleveland, Ohio, is calling attention to its carbons for arc lamps in a very handsome folder which it is mailing to the trade.

THE ELECTRIC SERVICE SUPPLIES COMPANY (Garton-Daniels department), Keokuk, Iowa, has bound up in one cover eight bulletins devoted to descriptions and illustrations of Garton-Daniels lightning arresters.

THE ARTHUR JONES COMPANY, Old Colony Building, Chicago, Ill., is distributing a complete stock list of its new "National" direct-current motors and generators, which it has in stock at Milwaukee, Wis., for immediate shipment.

THE HUNTER FAN AND MOTOR COMPANY, Fulton, N. Y., has published a very beautiful catalogue descriptive of "Tuerk" fans. The complete text is supplemented with illustrations in colors. Copies of this catalogue will be furnished upon request.

HOLMES & ALLEN, Wellington, New Zealand, have ready for distribution a series of interesting literature descriptive and illustrative of its automatic non-fouling swiveling trolley head for electric tramway systems. This literature will be sent to any one interested upon request.

THE INDIA RUBBER AND GUTTA PERCHA INSULATING COMPANY, 253 Broadway, New York city, is receiving many requests for its new price book on "Habirshaw" wires and cables. Copies of this book may be had upon application to the company at its New York city office.

WILLIAM S. BROWN, 3 West Twenty-ninth street, New York city, has arranged with the Enameled Metals Company, Pittsburg, Pa., to act as its eastern sales agent for the sale of "Pittsburg Standard" enameled rigid conduit, and will carry a complete stock. W. A. Treadwell will be connected with the New York office.

THE ELECTRIC CONTROLLER AND SUPPLY COMPANY, Cleveland, Ohio, in bulletin No. 107, describes and illustrates type G controllers. The illustrations and descriptive matter are very complete. This company's bulletins are unusually satisfactory, as the amount of data which is given affords a thorough understanding of the details of the apparatus.

THE RAIL JOINT COMPANY OF CANADA, LIMITED, Montreal, Canada, has been organized to take over the patents and business of the Continuous Rail Joint Company of Canada, Limited. The headquarters will be at 216 Board of Trade Building, Montreal. This company has commenced the manufacture of its products in Canada, and is prepared to make prompt deliveries.

THE WESTERN ELECTRIC COMPANY, Chicago, Ill., is distributing three attractive bulletins, exploiting and describing in detail the new lines of "Sunbeam" lamps being marketed by the company. The bulletins include "Sunbeam" tantalum lamps, "Sunbeam" Gem fifty-watt lamps and "Sunbeam" Gem high-efficiency, high-candle-power lamps. Copies of these bulletins will be furnished upon request.

THE R. THOMAS & SONS COMPANY, 39 Cortlandt street, New York city, now has the exclusive right to make and market the P. E. M. Company knob, which is the two-piece porcelain insulator formerly known as the W. E. split knob, manufactured by the Porcelain Electrical Manufacturing Company, of Trenton, N. J. This insulator will now be known as the Thomas T. P. I. knob. This announcement is made by Larrabee & Nichols, owner of the patents, Bennington, Vt.

MR. J. S. PENNEFATHER, 116 West Thirty-ninth street, New York city, formerly manager of the Globe Electric Company, has severed his connection with that company, and will manufacture electrical equipment for theatres under the firm name of J. S. Pennefather, with an office at the above address. Mr. Pennefather recently secured the switchboard interests of the Chase-Shawmut Company, and will continue the manufacture of high-grade theatre switchboards and kindred equipment.

THE WESTINGHOUSE MACHINE COMPANY, East Pittsburg, Pa., is publishing a new catalogue descriptive and illustrative of the Westinghouse storage battery for stationary use. The company asserts that these batteries will meet the most exacting demands required of the present-day storage battery. Exhaustive and elaborate tests during the development of the Westinghouse battery have shown features of unusual merit. The positive and negative plates are made of pure lead, without tin, antimony or other alloy. The active material is formed from the lead itself by a Planté process, with sulphuric acid as an electrolyte. Copies of this catalogue may be secured upon request.

Record of Electrical Patents.

Week of March 5.

845,754. LAMP SOCKET. Charles A. Chase, Chicago, Ill. The socket is supported by a perforated plate.

845,796. MULTIPLEX TELEPHONY. Jacob W. Lattig, Wyncote and Charles L. Goodrum, Philadelphia, Pa. Utilizes a phantom circuit.

845,831. MOTOR-CONTROLLER. Thomas S. Watson, Milwaukee, Wis. A controller for intermittently changing the direction of rotation.

845,836. ELECTRIC IGNITER. John D. Wilmot, Denver, Col. The igniting points are carried on tongs.

845,848. ELECTRICAL SWITCH. Ernest W. Brackett. Elyria, Ohio, assignor to the Dean Electric Company, Elyria, Ohio. A telephone hook switch.

845,856. METHOD OF AN APPARATUS FOR BRAKING VEHICLES. George H. Condict, Plainfield, N. J. The motor is operated as a generator.

845,858. COMBINED SOUNDER AND RESONATOR. Stewart F. Cox, Sallisaw, I. T. The sounder is mounted on a resonator box.

845,890. ELECTRICALLY DRIVEN STEP-BY-STEP MACHINE. Arthur F. Poole, Wheeling, W. Va. A clock-driving mechanism.

845,894. THERMOSTAT. Henry E. Reeve, New York, N. Y., assignor to Automatic Fire Alarm Company, New York, N. Y. The contact plates are enclosed in a chamber filled with insulating material.

845,900. TROLLEY WHEEL AND HARP. Edward S. Roland, Cleveland, Ohio. The current-bearing section and side flanges are separable.

845,922. FREQUENCY AND VOLT INDICATOR. Joshua F. Begole, St. Louis, Mo., assignor to Wagner Electric Manufacturing Company, St. Louis, Mo. Two movable parts are provided, one deflecting proportionally to the frequencies and voltage, and the other proportionally to voltage. Scales show both movements.

845,956. FREQUENCY-INDICATOR. Alexander S. Langsdorf, St. Louis, Mo., assignor to Wagner Electric Manufacturing Company, St. Louis, Mo. Two movable parts, one deflecting proportionally to the frequency and voltage, the other to the voltage.

845,991. ALARM SIGNAL. Robert J. Zorge, Chicago, Ill., assignor to Zorge Safety Railway Equipment Company, Chicago, Ill. An electromagnet torpedo striker.

845,995. ELECTRICAL MEASURING INSTRUMENT. Adelbert O. Benecke, Newark, N. J., assignor to American Instrument Company. Two shafts in alignment coupled together by a spiral spring.

845,996. SHUNT FOR ELECTRICAL MEASURING INSTRUMENTS. Adelbert O. Benecke, Newark, N. J., assignor to American Instrument Company. A high-resistance layer clamped between conducting plates.

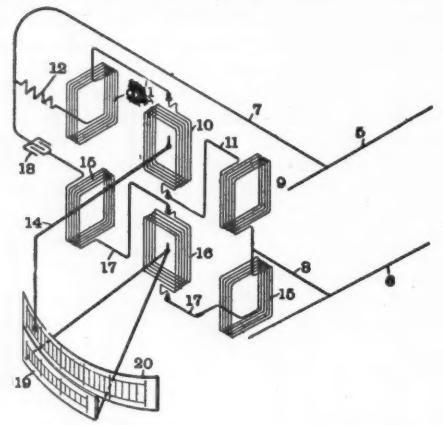
845,997. ELECTRICAL RESISTANCE. Adelbert O. Benecke, Newark, N. J., assignor to American Instrument Company, Newark, N. J. The resistance element is held in large metallic terminals for carrying away the heat developed.

846,068. ACOUSTICON. Kelley M. Turner, New York, and Norton W. Johnston, Chappaqua, N. Y., assignors, by mesne assignments, to General Acoustic Company. A number of transmitters facing several ways are mounted together.

846,081. RECEIVER. Louis W. Austin, Washington, D. C., assignor to National Electric Signaling Company, Pittsburg, Pa. A thermo-couple consisting of tellurium and silicon.

846,084. ELECTRICAL MEASURING INSTRUMENT. Adelbert O. Benecke, Newark, N. J., assignor to American Instrument Company, Newark, N. J. The resistance of the instrument is automatically adjusted as the cover is opened.

846,114. ELECTRICAL WINDING. Jacob W. Lattig, Wincote, and Charles L. Goodrum, Philadelphia, Pa. A coil for transmission systems, the windings, composed of two wires, being laid on a core so that their turns for equal current will produce substantially equal magnetic effects.



845,922.—Frequency and Volt Indicator.

846,120. ELECTRICAL SWITCH. Ray H. Manson, Elyria, Ohio, assignor to The Dean Electric Company, Elyria, Ohio. A hook-switch.

846,122. RAIL-BOND. George A. Mead, Mansfield, Ohio. A laminated rail-bond.

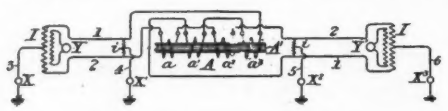
846,158. SOCKET BUSHING OR FITTING FOR ELECTRICAL PURPOSES. William B. Stewart, Philadelphia, Pa. A bushing in sections.

846,185. ELECTRICAL INDICATING DEVICE. Charles Crandall, Newport, R. I. A block-signal system.

846,205. TROLLEY-HARP. Charles Hibbard and Warren Hibbard, Sandy Hill, N. Y., assignors to Glens Falls Improved Trolley Fork Company, Glens Falls, N. Y. A method of construction.

846,214. VOLTAGE-REGULATOR FOR ALTERNATING-CURRENT GENERATORS. Frederick R. Keller, Lancaster, Pa. A rotary converter, drawing current from the supply, is connected in the exciter circuit.

846,223. MEANS FOR MAINTAINING CONSTANT THE VOLTAGE OF AN ELECTRIC CIRCUIT. Thomas Marshall, Chicago, Ill. A generator excited from constant voltage circuit, with an opposing regulating winding across a variable voltage circuit.



846,114.—Electrical Winding.

846,227. ELECTRIC MOTOR. David Mendelson, Brooklyn, N. Y. A bell ringer.

846,276. ELECTRIC SIGNAL CONTROL. Mathew Abt, New York, N. Y. An elevator signal system.

846,326. RAILWAY GATE-OPERATING MECHANISM. Milton H. Loudon, Kansas City, Mo. An automatic gate.

846,327. CALLING DEVICE FOR TELEPHONE EXCHANGES. Frank A. Lundquist, Chicago, Ill. A distinctive signal is made.

846,328. REGISTERING DEVICE FOR TELEPHONE EXCHANGES. Frank A. Lundquist, Chicago, Ill. A registering system for automatic exchanges.

846,336. AUTOMATIC FIRE-SIGNAL SYSTEM. Robert L. McElroy, John E. Shepherd and James G. Nolen, Chicago, Ill., assignors, by direct and mesne assignments, to Automatic Fire Protection Company. A thermostatic system.

846,339. SAFETY THIRD RAIL FOR RAILWAY TRACKS. John McRaven, Little Rock, Ark. An A-shaped, centrally located third rail.

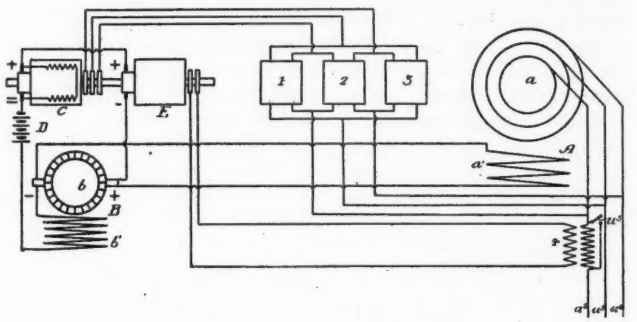
846,340. ELECTRIC SWITCH MECHANISM. Frank C. Newell, Wilkinsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. An electromagnetically operated device.

846,368. TELEPHONE SIGNALING DEVICE. Klas Weman, Buffalo, N. Y. A telephone call.

846,378. WIRE-RETRIEVING ATTACHMENT FOR TROLLEY WHEELS. William C. Althen, Columbus, Ohio, assignor of one-sixth to William F. Miesse, one-sixth to William N. Gearhart and one-sixth to Benjamin F. Hirt, Columbus, Ohio. A bracket for guiding the wires attached to the harp.

846,381. TELEPHONE EXCHANGE. Clarence A. Anderson, Salina, Kan., assignor of one-half to John Anderson, Salina, Kan. A lock-out party system.

846,382. SWITCHING MECHANISM. Clarence A. Anderson, Salina, Kan., assignor of one-half to John Anderson, Salina, Kan. A lock-out switch for telephones.



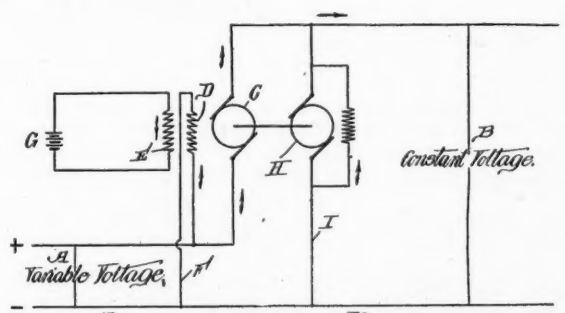
846,214.—Voltage-Regulator for Alternating-Current Generators.

846,394. TELEPHONE SYSTEM. Charles G. Burke and Edward J. Burke, Brooklyn, N. Y., assignors of one-half to John Q. A. Whittemore, Boston, Mass. Distinctive signals are given when calling and when the conversation is completed.

846,404. ELECTRIC FUSE. Louis W. Downes, Providence, R. I. An enclosed fuse.

846,413. TELEPHONE SYSTEM. Isidor Kitsee, Philadelphia, Pa. A central energy system.

846,414. RECEIVING DEVICE FOR ELECTRIC TRANSMISSION. Isidor Kitsee, Philadelphia, Pa., assignor of one-half to William J. Latta, Philadelphia, Pa. Two coils are employed, each neutralizing the effect of the other.



846,422.—Dynamo-Electric Machine.

846,415. TELEGRAPHY. Isidor Kitsee, Philadelphia, Pa., assignor of one-half to William J. Latta, Philadelphia, Pa. A telegraph transmitter.

846,416. TELEGRAPHIC RECEIVING DEVICE. Isidor Kitsee, Philadelphia, Pa. Uses a liquid resistance.

846,422. DYNAMO-ELECTRIC MACHINE. Ernst Oelschläger, Charlottenburg, Germany, assignor to Siemens-Schuckert Werke, Gesellschaft mit Beschränkter Haftung, Berlin, Germany. A continuous-current starting-dynamo is connected in series with the motor.

846,427. ALTERNATING-CURRENT MACHINE WITH COMMUTATORS AND WITH COMPENSATING WINDINGS. Rudolf Richter, Charlottenburg, Germany, assignor to Siemens-Schuckert Werke, G. M. B. H., Berlin, Germany. Series and shunt compensated windings are employed.